Part Two

Settings, Impacts, and Mitigation Measures

2.1 Transportation

This section examines effects of the proposed transportation improvements in the 2001 RTP on future mobility in the Bay Area, and the ability of proposed investments in transit, freeways and local roads, and operational strategies to serve expected growth in travel demand.

SETTING

The Bay Area contains over 19,600 miles of local streets and roads, and over 1,400 miles of state highways. In addition, there are over 9,860 transit route miles of service including rapid rail, light rail, commuter, diesel and electric buses, cable cars and ferries. The Bay Area also has an extensive local system of bicycle routes and pedestrian facilities (paths and sidewalks). Bay Area residents make about 21 million person trips per day divided among the following transportation modes: 82.2 percent autos, 6.2 percent transit, 1.3 percent bike, and 10.3 percent walk.

Cars, buses and commercial vehicles travel about 128 million miles a day (1998) on the Bay Area freeways and local roads. Transit serves about 1.1 million riders on the average weekday (measured in linked trips, not total boardings).

PROJECTED TRIPS IN THE YEAR 2025

Projected population and employment growth in the Bay Area over the next 25 years will lead to further travel demand and hence the need for additional transportation investment. Total person trips are projected to increase by 24 percent, or close to one percent per year on average. This growth rate is higher than population growth, projected at 19 percent, but lower than the growth in employment (33 percent).

There will also be substantial growth in trips from neighboring counties to the Bay Area as they increasingly supply homes for Bay Area workers, who are unable to find affordable housing in the nine counties. There are three major gateways with significant interregional trips: San Joaquin Valley (Altamont Pass), I-80 (Sacramento), and Route 17 (Santa Cruz). Emerging gateways include US 101 South (San Benito and Monterey counties). In addition, Route 152 (San Joaquin County to Santa Clara County) is a major commercial truck route from the San Joaquin Valley into the Bay Area, and Route 4 accesses the Central Valley as well.

GROWTH IN TRIPS

Projected increases in the number of trips made by persons living in the Bay Area (called person trips) derive from future population and employment growth forecasted by ABAG. These trips are made for a variety of purposes as shown in Table 2.1-1. Overall, a 24 percent increase in daily person trips is projected between 2000 and 2025. Home-based work trips are projected to increase at the fastest rate, which is the same as the growth rate in Bay Area employment. As with the movement of people, the number of commercial truck trips will also increase to serve both the new population and additional freight needs of a growing economy. These trips are estimated to increase by 32 percent.

Table 2.1-1: Growth in Regional Population/Employment and Trips (2000 and 2025)

	2000	*2025*	*Change*	*Percent Change*
Demographic Characteristics				
Total Population	6,930,639	8,224,108	1,293,469	19
Employed Residents	3,537,997	4,625,186	1,087,189	31
Total Employment	3,688,595	4,906,829	1,218,234	33
Mean Household Income (1989$)	$63,552	$79,035	15,483	24
Trip Purpose				
Home-Based Work	5,311,454	7,077,676	1,766,222	33
Home-Based Shop/Other	5,550,245	6,645,025	1,094,780	20
Home-Based Social/Recreation	2,516,844	3,143,109	626,265	25
Home-Based School	1,939,181	1,984,835	45,654	2
Non-Home-Based	5,812,056	7,376,191	1,564,135	27
Sub-Total, Intraregional Personal Travel	*21,129,780*	*26,226,836*	*5,097,056*	*24*
Commercial	269,937	355,762	85,825	32

Source: Metropolitan Transportation Commission, 2001

REGIONAL TRAVEL PATTERNS

Regional travel must be analyzed both in aggregate terms and spatially in terms of where these trips are expected to occur on the regional transportation system. Commute trips (home-based work trips) are generally longer than trips for other purposes (see Table 2.1-2) and are highly concentrated around the morning and evening commute periods. The morning period typically involves about 60 percent work trips, while the evening tends to have a slightly lower work trip percent (50 percent) as there are more non-work trips that need to use the transportation system in the evening. As expected, the longest average commutes are from Solano County and Contra Costa County, which have significant proportions of workers with jobs in the central urban core.

The volume of trips between different Bay Area origins and destinations define significant travel corridors. Thus the RTP organizes much of the information by travel corridor, as defined in Figure 1.2-7. Because sub-regional transportation planning functions are often undertaken at the county level, Table 2.1-3 displays projected future county-to-county travel patterns. Table 2.1-4 then details this trip activity at the corridor level for consistency with the EIR format.

Table 2.1-2: Average Commute Distance Projected in the Year 2025

County of Residence	*Average One-Way Commute Distance (miles)*
Alameda	14.4
Contra Costa	17.3
Marin	16.4
Napa	14.4
Santa Clara	11.6
San Francisco	9.4
San Mateo	14.2
Solano	19.7
Sonoma	15.3

Source: Metropolitan Transportation Commission, 2001

Table 2.1-3: Projected Person Trips Between Counties in the Year 2025
(Thousands of Trips and Percent Change from 2000)

	Destination									
Origin	*Alameda*	*Contra Costa*	*Marin*	*Napa*	*Santa Clara*	*San Francisco*	*San Mateo*	*Solano*	*Sonoma*	*Total*
Alameda	4,067	203	14	4	276	242	144	13	8	4,971
	22%	37%	62%	74%	20%	30%	25%	52%	93%	23%
Contra Costa	431	2,824	15	11	47	195	41	58	9	3,630
	36%	35%	51%	67%	37%	31%	30%	42%	86%	35%
Marin	14	10	722	3	4	107	12	4	33	908
	16%	29%	16%	63%	10%	11%	10%	39%	70%	17%
Napa	6	9	3	437	1	6	1	19	35	517
	20%	31%	45%	39%	49%	20%	21%	54%	79%	41%
Santa Clara	176	18	3	1	6,694	54	238	2	2	7,187
	38%	40%	45%	54%	21%	32%	25%	50%	44%	21%
San Francisco	118	36	35	2	51	2,171	269	5	7	2,694
	14%	21%	22%	59%	6%	7%	14%	38%	55%	9%
San Mateo	93	21	10	1	308	426	2,067	2	2	2,930
	27%	35%	36%	45%	16%	119%	15%	43%	52%	16%
Solano	52	119	13	43	7	38	14	1,301	10	1,597
	38%	47%	60%	123%	34%	37%	37%	55%	87%	54%
Sonoma	10	7	53	29	3	26	5	5	1,653	1,791
	1%	9%	17%	27%	28%	-2%	-5%	31%	39%	37%
Total	***4,967***	***3,247***	***868***	***529***	***7,392***	***3,264***	***2,791***	***1,410***	***1,788***	***26,225***

Note: Column totals may not sum county totals due to rounding.

Source: Metropolitan Transportation Commission, 2001

Table 2.1-4: Growth in Person Trips by Corridor (1998 to 2025)

Description	*1998 Total*	*2025 Total*	*Percent Growth*
Golden Gate	1,997,256	2,676,270	34
North Bay East-West*	58,678	102,151	74
Transbay - Richmond / San Rafael*	48,076	86,089	79
San Francisco	3,299,729	3,914,565	19
Transbay - San Francisco/Oakland*	539,570	768,911	43
Peninsula	2,994,172	3,675,431	23
Transbay - Dumbarton, San Mateo-Hayward*	177,291	261,977	48
Silicon Valley	6,154,034	7,884,660	28
Fremont-South Bay*	212,102	296,010	40
Eastshore South	2,577,298	3,033,523	18
Sunol Gateway*	118,762	225,780	90
Tri-Valley	502,890	872,301	73
Diablo	1,449,164	1,950,791	35
Delta	514,382	910,122	77
Eastshore North	1,591,018	2,195,706	38
Napa Valley	352,300	530,545	51

*Corridors that are primarily screenlines, reflecting trips across a geographic boundary such as a county line. Other corridors reflect areas with defined boundaries, and the reported trips represent all trips that occur totally within the corridor as well as all trips with one end within the corridor.

Source: Metropolitan Transportation Commission, 2001

TRANSPORTATION SUPPLY

The mix of investments in the proposed 2001 RTP consists of funding for transit and highway maintenance, rehabilitation and operations, system management/customer service programs, and system expansion. Maintenance and rehabilitation projects will not affect the travel behavior of Bay Area travelers, and system management will affect travel behavior in subtle and localized ways that are generally difficult to assess in a regional analysis. Transportation expansion projects included in the 2001 RTP will be responsible for the greatest impact on travel behavior and are therefore given the bulk of the attention in this EIR analysis. Table 2.1-5 provides a measure of the relative level of expansion contemplated in the proposed 2001 RTP, and notes differences for Project B (2001 RTP without federal New Starts funding).

Table 2.1-5: Roadway Lane Miles and Transit Supply (1998 to 2025)

	1998	2025 No Project	2025 Project	Percent Change (1998 to 2025 Project)	Change (No Project to Project) Numerical	Change (No Project to Project) Percent
Roadway Lane Miles						
Freeways	4,427	5,380	5,621	27	241	4
Mixed	4,173	5,012	5,109	22	97	2
HOV	254	368	512	102	144	39
Expressways	923	1,043	1,089	18	46	4
Mixed	873	977	1,023	17	46	5
HOV	50	66	66	32	0	0
Arterial/Other	14,023	13,588	13,640	-3	52	0
Total	*19,375*	*20,011*	*20,350*	*5*	*339*	*2*
Transit Supply[1]						
Bus Transit	1,365,270	1,410,330	1,470,102[2]	8	59,772	4
Light Rail Transit	143,011	249,856	268,134[3]	87	18,278	7
Rapid Rail Transit (BART)	1,058,138	1,279,215	1,452,045[4]	37	172,830	14
Commuter Rail Transit	473,046	645,204	672,602	42	27,398	4
Ferry Transit	96,720	115,860	115,860	20	0	0
Total	*3,136,185*	*3,700,465*	*3,978,743*	*27*	*278,278*	*8*

[1]AM peak period passenger seat miles per hour.
[2]1,478,200 in Project B.
[3]250,200 in Project B.
[4]1,307,400 in Project B.

Source: Metropolitan Transportation Commission, 2001

PROJECTED CHANGES IN TRANSPORTATION MODE AND VEHICLE TRAVEL

As discussed above, the provision of system capacity improvements in specific corridors will affect traffic levels on regional facilities and the use of Bay Area transit systems. Table 2.1-6 on the following page provides measures of regional travel activity for 2025, as forecasted by MTC.

Table 2.1-6: Projected Changes in Travel Behavior (1998 to 2025)

							Change (No Project to Project)	
	1998		*2025 No Project*		*2025 Project*		*Numerical*	*Percent*
Person Trips by Mode and Mode Share[1]								
Auto	16,985,546	84%	21,596,762	82%	21,566,008[5]	82%	-30,753[5]	-0.1%
Transit	1,129,152	6%	1,585,153	6%	1,617,945[6]	6%	32,792[6]	2.1%
Bike	270,421	1%	345,791	1%	343,292	1%	-2,499	-0.7%
Walk	1,855,080	9%	2,699,166	10%	2,699,626	10%	460	0.0%
Total Modes	*20,240,200*	*100%*	*26,226,862*	*100%*	*26,226,862*	*100%*	*0*	*0.0%*
Daily Transit Boardings[2, 7]	1,604,900		2,330,100		2,396,500		66,400	2.8%
Daily Vehicle Trips[3]	13,103,400		17,116,700		17,085,400		-31,300	-0.2%
Daily Vehicle Miles of Travel[4]	128,369,000		191,768,000		190,587,000		-1,181,000	-0.6%
Daily Vehicle Hours of Delay	339,100		959,400		854,600		-104,800	-11%
Average Delay Per Vehicle Trip (minutes)	1.6		3.4		3.0		-0.4	-11%

[1]Excludes commercial and interregional trips
[2]Daily transit boardings includes transfer boardings.
[3]Includes interregional trips
[4]Federal air quality conformity analysis will be based on CARB's VMT estimates.
[5]21,575,000 auto person trips in Project B, change relative to No Project alternative is -21,786.
[6]1,609,600 transit trips in Project B, change relative to No Project alternative is +24,469.
[7]Daily transit boardings in Project B is 2,389,300.
Note: Bike trips decline slightly in Project due to improved transit service which captures some trips.

Source: Metropolitan Transportation Commission, 2001

POLICY AND REGULATION

The federal and state legal framework for which the RTP is developed is described below.

FEDERAL STATUTES

Transportation Equity Act for the 21st Century

The Transportation Equity Act for the 21st Century (TEA-21) was signed into law in 1998 and built upon the initiatives established in the prior ISTEA legislation. TEA-21 reauthorized highway, highway safety, transit, and other surface transportation programs for six years (1998-2003), and significantly increased overall funding for transportation. TEA-21 continues the program structure established for highways and transit under the earlier ISTEA legislation, such as flexibility in the use of funds for a variety of locally defined purposes, including helping meet federal air quality standards. TEA-21 also encourages development of Intelligent Transportation Systems (ITS), to help improve operations and management of transportation systems and vehicle safety.

Metropolitan Planning General Requirements

Under TEA-21, the U.S. Department of Transportation (USDOT) requires that Metropolitan Planning Organizations, like MTC, prepare long range transportation plans and that these plans be updated every three years. MTC adopted the 1998 RTP in October 1998 and amended it in 1999 and 2000. The 2001 RTP will replace the 1998 RTP when adopted.

Key federal requirements for long range plans include the following:

- RTPs must be developed through an open and inclusive process that ensures public input and seeks out and considers the needs of those traditionally under served by existing transportation systems;
- RTPs must be developed for a period of not less than 20 years into the future; RTPs must reflect the most recent assumptions for population, travel, land use, congestion, employment, and economic activity;
- RTPs must have a financially constrained element, and transportation revenue assumptions must be reasonable;
- RTPs must conform to the applicable federal air quality plan, called the State Implementation Plan (SIP), for ozone and other pollutants for which an area is not in attainment; and
- RTPs must consider seven planning factors and strategies, in the local context.[1]

National Environmental Policy Act

The National Environment Policy Act of 1969 (NEPA) requires federal agencies to assess the possible environmental consequences of projects which they propose to undertake, fund, or approve. While the RTP is not subject to NEPA, individual federally funded programs or projects requiring federal approval will be subject to a NEPA evaluation.

STATE STATUTES

The State requirements largely mirror the Federal requirements and the State has adopted extensive RTP guidelines. Key additional requirements of the State include:

State Planning General Requirements

State planning guidelines call for the adoption and submittal of a RTP every three years to the California Transportation Commission (CTC) and Caltrans. If the current RTP is determined to be adequate such that an update is not warranted, a Regional Transportation Planning Agency, such as MTC, may re-adopt the current RTP. Also, the guidelines specify three elements of the RTP – a policy element, an action element, and a financial element.

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[1] For more details on the seven planning factors, see California Transportation Commission, *Regional Transportation Guidelines*, December 1999.

To qualify for funding in the State Implementation Improvement Program (STIP), projects included in a Regional Transportation Improvement Program (RTIP) and Interregional Transportation Improvement Program (ITIP) must be consistent with adopted RTPs. Given the requirements of Government Code 65080(c), the CTC will only consider STIP funding for projects consistent with an RTP adopted within three years of STIP adoption.

California Environmental Quality Act

The California Environmental Quality Act (CEQA) requires State and local agencies to consider the environmental consequences of projects which they undertake, fund, or permit. The RTP and any subsequent revisions, amendments, or updates must be in compliance with CEQA. Typically, a program or master Environmental Impact Report (EIR) is prepared for the RTP. This EIR for the 2001 RTP is a program EIR.

CRITERIA FOR SIGNIFICANCE

According to CEQA guidelines, a project will normally have a significant effect if it would cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system. This definition is somewhat limited for the purposes of a regional transportation program EIR, therefore, a more expansive set of criteria has been defined to determine whether proposed transportation improvements in the 2001 RTP will have a significant adverse effect on future regional mobility in the Bay Area:

Travel Time. This is a central measure of mobility since transportation improvements are generally intended to reduce travel times, particularly in highly congested corridors.

- **Criterion 1: Average travel time per trip.** Implementation of the 2001 RTP would have a potentially significant adverse impact if it results in an appreciable increase in average travel time per trip compared to the No Project Alternative.

Accessibility. Changes in accessibility will measure how easy it is to get to different types of activities or opportunities around the region. Arguably the most critical activity/opportunity is getting to work, because work supplies the resources to engage in other activities.

- **Criterion 2: Number of work opportunities within 15, 30, and 45 minutes by auto and transit.** Implementation of the 2001 RTP would have a potentially significant adverse impact if it results in an appreciable decrease in the average number of jobs within specified travel times from home by auto (combines single occupant autos and carpools) and transit compared to the No Project Alternative.

Traffic/Congestion. This measures is the closest criterion to the CEQA language and thus, the EIR evaluates the change in total vehicle trips (traffic) and changes in the amount of travel at different levels of service on freeways and local streets (congestion).

- **Criterion 3: Vehicle trips.** Implementation of the 2001 RTP would have a potentially significant adverse impact if it results in an appreciable increase in vehicle trips (traffic) compared to the No Project Alternative.

- **Criterion 4: Vehicle miles traveled (VMT) at level of service (LOS) F.** Implementation of the 2001 RTP would have a potentially significant adverse impact if it results in an appreciable increase in vehicle miles traveled (VMT) at level of service (LOS) F compared to the No Project Alternative (LOS F defines a condition on roads where traffic substantially exceeds capacity, resulting in very low speeds and stop and go conditions for extended periods of time).

METHOD OF ANALYSIS

The EIR analysis is based on travel projections developed using MTC's travel demand forecasting model. This model is actually a set of individual models that perform different functions, leading to projections of future Bay Area travel. The models are developed from a database that consists of the 1990 Census Transportation Planning Package (CTPP, or better known as the Journey-to-Work Package), the MTC 1990 Household Travel Survey, and traffic and transit counts which are used to validate the model results (information from the 2000 Census and 2000 MTC Household Travel Survey will not be available and usable for some time). Unless otherwise stated, the base year (existing conditions) for the analysis is 1998, the year of the last major travel model validation effort.

Typically travel demand models are based on four-step process. These four steps are: trip generation (how much travel?), trip distribution (where do people travel?), mode choice (what mode of travel?) and trip assignment (what road/highway or transit route?).

MTC additionally employs three more steps beyond the basic four-step process. These additional steps are auto ownership models (how many cars does a household own?), and working household models (do households have workers? If so, how many workers?) and time-of-day models (when do people travel during the day? How many people travel during the peak travel commute period?).

Key Assumptions

Underpinning the models are a series of key assumptions. These assumptions fall under two basic categories:

Travel Demand Assumptions:

- Land use/demographics (population, housing, jobs, workers, auto ownership, etc.).
- Pricing (gas costs, parking costs, bridge tolls, transit fares, etc.).

Transportation System Supply Inputs:

- Networks (capacity of system of streets and highways and frequency and travel time for transit routes).

References

For more information, MTC has a large body of detailed published documentation regarding its travel demand models. These, and other documents can be obtained from the MTC library, or from MTC's home page on the World Wide Web at www.mtc.ca.gov.

SUMMARY OF IMPACTS

AVERAGE TRAVEL TIME PER TRIP

As shown in Table 2.1-7, average travel time per trip for both the No Project and Project alternatives is projected to increase relative to existing conditions. This increase reflects the effect of continued growth in regional travel demand (trips) across all modes without a corresponding expansion in the capacity of the regional transportation system to accommodate these trips.

However, the Project Alternative would represent an overall improvement compared to the No Project Alternative for both work trips (5 percent reduction in travel time per trip) and non-work trips (1 percent reduction in travel time per trip), for an overall 3 percent improvement.

Table 2.1-7: Average Travel Time Per Trip (1998 to 2025, in minutes)[1]

				Change (No Project to Project)	
	1998	*2025 No Project*	*2025 Project*	*Numerical*	*Percent*
Work Trips Total	27.2	35.5	33.9	-1.6	-5%
Non-Work Trips Total	15.3	16.8	16.5	-0.2	-1%
Total Personal Trips	18.2	21.8	21.2	-0.6	-3%
Truck Trips Total	25.7	30.3	29.4	-1.0	-3%

[1]No difference between Project alternative and Project B.

Source: Metropolitan Transportation Commission, 2001.

ACCESSIBILITY

Accessibility is calculated as the total employment within 15, 30 or 45 minutes of the neighborhood-of-residence by mode of transportation. For regional transportation planning the Bay Area is divided into 1,099 neighborhoods (travel analysis zones). Mode of transportation includes drive alone, carpool, transit, bicycle and walk. After the total employment accessible to each neighborhood is obtained, each neighborhood's accessibility value is weighted by the total population of the neighborhood/zone and all zones are summed to derive a regional weighted accessibility value. Higher accessibility values means better accessibility to jobs, shopping and other opportunities. Remote communities on the periphery of the Bay Area, e.g., Guerneville, Cloverdale, Gilroy) tend to have the lowest accessibility scores.

Projected changes in accessibility from 1998 to 2025 are the result of two factors, changing land use patterns over this period, and the transportation investments in the RTP. Compared to 1998, accessibility to total jobs would generally decline for auto users and increase for transit users, due to the significant transit investments in both the No Project and Project alternatives (see Table

2.1-8). The decline in auto accessibility is primarily related to increases in travel times on the region's freeways and arterials, and to a lesser extent the shift is land use patterns. Even with the investments in the Project Alternative, accessibility by auto will not match 1998 levels (as alluded to above, some of this effect may be due to shifts in land use patterns as well).

Comparing the Project Alternative with the No Project Alternative shows there will be improved accessibility across all modes, ranging from 2 percent to 9 percent. The margin of improvement for transit will generally be slightly less than auto, given the significant regional transit investments that are already in place in the No Project Alternative and the comparatively smaller incremental effect of the additional transit projects in the Project Alternative.

Table 2.1-8: Accessibility to Jobs Opportunities (1998 to 2025)

				Change (No Project to Project)		
	1998	*2025 No Project*	*2025 Project*	*Numerical*	*Percent*	*Project B*
Number of Total Jobs Accessible by Auto						
Within 15 minutes	126,911	122,427	128,403	5,976	5	128,363
Within 30 minutes	513,357	452,391	489,797	37,406	8	491,765
Within 45 minutes	1,016,056	876,457	957,397	80,940	9	956,853
Number of Total Jobs Accessible by Transit						
Within 15 minutes	3,715	4,642	4,717	75	2	4,660
Within 30 minutes	55,486	70,258	74,299	4,041	6	73,147
Within 45 minutes	209,497	269,364	290,697	21,333	8	283,369
Regional Total Jobs	*3,504,118*	*4,906,829*	*4,906,829*	*0*	*0*	

Source: Metropolitan Transportation Commission, 2001

DAILY VEHICLE TRIPS

Forecasted daily Vehicle Trips in the Bay Area would increase by about 29 percent from 1998 to 2025 due to growth in the region. Overall the Project Alternative would reduce vehicle trips by 0.2 percent compared to the No Project Alternative.

As illustrated in Table 2.1-9, a comparison between the Project and No Project Alternative show that the Project Alternative reduces vehicle trips in all corridors, except for small increases in two corridors: Delta (130 additional vehicle trips) and Napa Valley (with 714 additional vehicle trips). Significant decreases in vehicle trips are evident in a number of corridors, most notably: Silicon Valley (11,415 less trips in Project Alternative relative to No Project Alternative), Golden Gate (9,190 less trips in Project Alternative relative to No Project Alternative), and San Francisco (8,068 less trips in Project Alternative relative to No Project Alternative).

Table 2.1-9: Daily Vehicle Trips by Corridor (1998 to 2025)

Corridor Description	1998 Vehicle Trips	2025 No Project Vehicle Trips	2025 Project Vehicle Trips	Change (No Project to Project) Numerical	Change (No Project to Project) Percent
Golden Gate	1,389,567	1,816,125	1,806,935	-9,190	-0.5%
North Bay East-West	50,708	89,322	89,172	-150	-0.2%
Transbay - Richmond / San Rafael	41,625	74,397	73,682	-714	-1.0%
San Francisco	1,554,966	1,778,106	1,770,038[1]	-8,068	-0.5%
Transbay - San Francisco/Oakland	307,250	406,007	405,029	-978	-0.2%
Peninsula	2,090,238	2,559,217	2,553,559[2]	-5,658	-0.2%
Transbay - Dumbarton, San Mateo-Hayward	147,948	217,071	216,663	-408	-0.2%
Silicon Valley	4,276,894	5,468,290	5,456,875[3]	-11,415	-0.2%
Fremont-South Bay	178,261	245,572	241,227[4]	-4,345	-1.8%
Eastshore-South	1,574,541	1,852,892	1,848,653	-4,239	-0.2%
Sunol Gateway	111,588	203,552	202,363	-1,189	-0.6%
Tri-Valley	336,693	579,155	577,635	-1,520	-0.3%
Diablo	1,018,948	1,364,154	1,362,779	-1,375	-0.1%
Delta	337,430	597,589	597,725	136	0.0%
Eastshore-North	928,429	1,291,659	1,290,857	-802	-0.1%
Napa Valley	242,507	359,129	359,842	714	0.2%
Regional Total	12,874,048	16,659,878	16,628,640	-31,238	-0.2%

[1]San Francisco corridor is 1,771,600 vehicle trips in Project B.
[2]Peninsula corridor is 2,555,500 vehicle trips in Project B.
[3]Silicon Valley corridor is 5,462,300 vehicle trips in Project B.
[4]Fremont/South Bay is 243,215 vehicle trips in Project B.
Note: All differences in vehicle trips at the corridor level comparing Project B to Project alternative are negligible (<0.3% in all corridors).

Source: Metropolitan Transportation Commission, 2001

VEHICLE MILES TRAVELED BY FACILITY TYPE AND V/C RATIO (LEVEL OF SERVICE)

Table 2.1-10 displays vehicle miles of travel by type of travel (i.e., freeways versus arterials and expressways) and volume-to-capacity ratio (V/C). The volume-to-capacity ratio is a way of describing the level of service experienced by users of a road, depending on the number of vehicles traveling on the facility and the available capacity. As traffic increases, the V/C ratio rises to a point of saturation where the road cannot carry any more vehicles (a ratio of 1.0 or greater). V/C ratios are also commonly expressed as a range of letters from A to F, with "A" being the least congested, and "F" indicating more traffic than the road's capacity. When V/C is expressed as a letter (A-F), the condition is referred to level-of-service (LOS).

Overall, regional VMT during the morning (AM) peak period is projected to increase by 36 percent over existing conditions for the Project and No Project alternatives. The amount of VMT at LOS F (severe congestion) in the Project alternative for all facilities is 3.5 times higher in 2025 than existing conditions. This substantial increase reflects regional growth and the limited amount of new roadway capacity that can be funded in the 2001 RTP.

However, relative to the No Project Alternative, the implementation of the Project Alternative will reduce the amount of VMT at LOS F by 15 percent on freeways and 14 percent on expressways and arterials. Thus, although there would be deterioration in morning peak hour traffic conditions compared to 1998, the proposed 2001 RTP would represent an improvement over the No Project Alternative.

Table 2.1-10: AM Peak Period Regional VMT by Facility Type and Volume to Capacity (V/C) Ratio (1998 to 2025)

								Change (No Project to Project)	
V/C Ratio	*LOS*	*1998*		*2025 No Project*		*2025 Project*		*Numerical*	*Percent*
Freeways									
< 0.75	A-C	5,626,945	53%	3,934,834	28%	4,521,349	32%	586,515	15
0.75 - 1.00	D-E	4,639,556	44%	7,774,601	56%	7,805,956	55%	31,355	0
> 1.00	F	382,698	4%	2,201,030	16%	1,863,037	13%	-337,993	-15
Total		*10,649,199*	*100%*	*13,910,465*	*100%*	*14,190,342*	*100%*	*279,876*	*2*
Expressways and Arterials									
< 0.75	A-C	5,530,645	71%	6,145,676	55%	6,137,288	57%	-8,389	0
0.75 - 1.00	D-E	1,605,975	21%	3,104,661	28%	3,065,422	28%	-39,239	-1
> 1.00	F	624,117	8%	1,871,792	17%	1,615,460	15%	-256,332	-14
Total		*7,760,737*	*100%*	*11,122,129*	*100%*	*10,818,169*	*100%*	*-303,960*	*-3*
All Facilities									
< 0.75	A-C	11,157,590	61%	10,080,510	40%	10,658,637	43%	578,126	6
0.75 - 1.00	D-E	6,245,531	34%	10,879,262	43%	10,871,377	43%	-7,884	0
> 1.00	F	1,006,815	5%	4,072,822	16%	3,478,497	14%	-594,325	-15
Total		*18,409,936*	*100%*	*25,032,594*	*100%*	*25,008,511*	*100%*	*-24,083*	*0*

Notes:
[1] AM Peak Period is two hours.
[2] Freeways include Freeways and Freeway-to-Freeway connectors. Expressways and Arterials include all other facilities.
[3] LOS - Level of Service measures traffic density in a range of A to F.
[4] LOS A are free-flow conditions with no delay; LOS D-E are more congested conditions with some delay possible; LOS F represents conditions of over-capacity and significant delay.
[5] Project B AM Peak Period Total VMT is 24,972,000. Project B Freeway VMT is slightly higher at 14,210,700. Project B expressway and arterial VMT is slightly lower at 10,761,200. Distribution of VMT by V/C ratio is same in Project B as Project alternative.

Source: Metropolitan Transportation Commission, 2001

DIRECT IMPACTS

Direct Impacts

The direct impacts related to implementation of the 2001 RTP are described above under Summary of Impacts.

Short Term Impacts

Implementation of the 2001 RTP will be a continuing process over many years. Short-term impacts would consist of delays to travelers caused by congestion in and around construction zones. Significant numbers of construction projects occurring at the same time could cause cumulative regional delay impacts.

SIGNIFICANT IMPACTS AND MITIGATION MEASURES

IMPACT

2.1-1 Many transportation impacts show negative trends between 1998 and 2025 such as average travel time, auto accessibility to jobs, increases in VMT at LOS F, etc. (The one indicator that does show improvement is total jobs accessible by transit). These trends are the result of sustained population and economic growth that will occur in the region between 2000 and 2025 and the mismatch between travel demand and the supply of new capacity. However, in each of the impact areas evaluated the Project Alternative provides a significant improvement over the No Project Alternative. In addition, the Project provides further benefits that are not measured by funding shortfalls in pavement maintenance for local streets, capital rehabilitation needs of transit, and the costs of many ongoing regional programs directed at better system management and customer service.

MITIGATION MEASURES

There are no significant adverse effects on mobility due to implementation of the proposed 2001 RTP. The effects are all beneficial compared to the No Project Alternative.

2.2 Air Quality

This air quality analysis focuses on the criteria pollutants which affect public health and for which the Bay Area is currently designated as a non-attainment area for the national standards (ozone[1]) and state standards (ozone and PM_{10}). The analysis also discusses toxic air contaminants which refers to pollutants that occur in relatively low concentrations and can have adverse health impacts, but for which no ambient air quality standards have been established. In both cases, the pollutants discussed are those that are produced by mobile sources-autos, buses, and trucks. Implementation of the proposed transportation improvements in the 2001 RTP could affect these pollutants through changes in travel behavior and vehicle activity (amount of travel and speed).

SETTING

Air quality problems are connected to health effects associated with certain types of pollutants. Automobiles, buses and ferries, and diesel powered rail systems all generate emissions, as would the generation of power for transit operated with electricity. The main pollutants addressed in this chapter are regional in character. Localized pollutants such as carbon monoxide are more appropriately addressed in project level environmental documents. However, it should be noted that new fuel requirements established by the California Air Resources Board (CARB) have all but eliminated carbon monoxide as an air quality problem.

CLIMATE, METEOROLOGY, AND TOPOGRAPHY

Regional wind patterns vary from season to season. Wind tends to move from areas of high-pressure to low-pressure areas. In warmer months, this means that air blows on-shore from the Pacific Ocean to inland areas. While Pacific Ocean air is generally free of harmful air pollutants, it receives emissions from numerous sources (built and natural), and will then carry these pollutants to areas many miles away. Mountains and valleys often affect on-shore winds. This means that a wind pattern that started as northwesterly will often swing 90 degrees or more when it encounters topographic features.

Normally, air temperatures decrease with increasing elevations. Sometimes this normal pattern is inverted, with warmer air aloft, and cool air trapped near the earth's surface. This phenomenon occurs in all seasons. In summer, especially when wind speeds are very low, a strong inversion will trap air emissions and high levels of ozone smog can occur. In winter, a strong inversion can trap emissions of particulate and carbon monoxide near the surface, resulting in unhealthful air quality.

Wet winters and dry summers characterize the region's Mediterranean climate. Rainfall totals can vary widely over a short distance, with windward coastal mountain areas receiving over 40 inches of rain, while leeward areas receive about 15 inches. During rainy periods, horizontal and vertical

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[1]In August 1998, the Bay Area was redesignated to non-attainment, unclassified for the national 1-hour ozone standard.

air movement ensures rapid pollutant dispersal. Rain also washes out particulate and other pollutants.

The Bay Area topography is complex, consisting of coastal mountain ranges, inland valleys, and bays. The Pacific Ocean bounds the area to the west with warmer inland valleys to the south and east. The only major break in California's Coast Range occurs at San Francisco Bay. The gap on the western side is called the Golden Gate, and on the eastern side is called the Carquinez Strait. These gaps allow air to pass between the Central Valley and the Pacific Ocean. The general region lies in the semi-permanent high-pressure zone of the eastern Pacific, resulting in a mild climate tempered by cool sea breezes with light average wind speeds. The usually mild climatological pattern is interrupted occasionally by periods of extremely hot weather, winter storms, or offshore winds.

The pollution potential of an area is largely dependent on winds, atmospheric stability, solar radiation, and terrain. The combination of low wind speeds and low inversions produces the greatest concentration of air pollutants. On days without inversions, or on days of winds averaging over 15 miles per hour (mph), smog potential is greatly reduced. Because of wind patterns, and to a lesser degree the geographic location of emission sources, high ozone levels usually occur in inland valleys, such as Livermore. High PM_{10} levels can occur in most valley areas where residential wood smoke and other pollutants are trapped by inversions and stagnant air.

CRITERIA POLLUTANTS

Existing regulations address regional and local ambient air quality. The U.S. Environmental Protection Agency (EPA), under the authority of the 1970 Clean Air Act (1970 CAA), set national ambient air quality standards for various air pollutants, known as criteria pollutants. These include carbon monoxide (CO), ozone (O_3), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (PM_{10} and $PM_{2.5}$), and lead (Pb). California has also established state ambient air quality standards, some of which are more stringent than the national standards.

This EIR focuses on the pollutants for which the Bay Area is currently designated as a non-attainment area for the national standards (ozone[2]) and state standards (ozone and PM_{10}). Ozone is formed by a photochemical reaction involving nitrogen oxide (NO_X) and reactive organic gases (ROG), so the emissions of these two pollutants are a concern. The EIR also includes estimates of CO emissions, although the Bay Area is designated as a federal CO maintenance area, having attained the federal CO standard (and is also classified as a state CO attainment area). Particulate matter is also a concern given the region's non-attainment status for state standards for small particulates (PM_{10}). In addition the U.S. EPA is considering setting standards for even smaller particulates, called $PM_{2.5}$.

[2]In August 1998, the Bay Area was redesignated to non-attainment, unclassified for the national 1-hour ozone standard.

Ozone

Ozone is a reactive pollutant, which is not emitted directly into the atmosphere, but is a secondary air pollutant produced in the atmosphere through a complex series of photochemical reactions involving ROG and NO_X. ROG and NO_X are known as precursor compounds of ozone. Ozone is a regional air pollutant because it is formed downwind of sources of ROG and NO_X under the influence of wind and sunlight. During summertime (particularly on hot, sunny days with little or no wind), ozone levels are at their highest levels.

Short-term exposure to elevated concentrations of ozone is linked to such health effects as eye irritation and breathing difficulties. Repeated exposure to ozone can make people more susceptible to respiratory infections, and aggravate preexisting respiratory diseases. Long-term exposures to ozone can cause more serious respiratory illnesses. Ozone also damages trees and other natural vegetation, reduces agricultural productivity, and causes deterioration of building materials, surface coatings, rubber, plastic products and textiles.

Emission reductions have been occurring throughout the last decade, and the Bay Area was designated an attainment area for the national 1-hour ozone standard in 1995 based on low ozone levels from 1990 to 1994. The region was subsequently re-designated back to non-attainment in 1998 after several years of unusually hot weather. The Bay Area meets the 1-hour national ozone standard more than 99 percent of the time; however, on occasion very hot weather can cause the standard to be exceeded even in the face of declining emissions from stationary and transportation sources. Table 2.2-1 indicates the number of exceedances recorded at each monitoring station from 1990 to 2000. Livermore is the only station that averages over one exceedance per year in this 11-year period.

According to the latest inventory of emissions prepared by the Bay Area Air Quality Management District, on road motor vehicle emissions constitute 45 percent of volatile organic compounds (VOC) and 49 percent of nitrogen oxides in 2000.[4] The remainder of the emissions comes from petroleum and solvent evaporation, other mobile sources, combustion, and a variety of industrial and commercial sources[5]. On road emissions are expected to decline to 38 percent of VOC and 45 percent of NO_X by 2006.

As in past analysis of long-term emission trends, it is expected that CARB's regulation on vehicles and fuels will continue to lower vehicle emissions substantially over the next 25 years.

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[4] Bay Area Air Quality Management District, *Bay Area 2000 Clean Air Plan and Terminal Assessment,* December 20, 2000
[5] Ibid.

Table 2.2-1: Days Exceeding the 1-Hour National Ozone Standard (1990-2000)

Station	*1990*	*1991*	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*	*Total*	*Annual Avg.*
Livermore- Old First	1	1	0	1	2	7	8	0	6	2	2	30	2.73
Livermore- Rincon											1	1	1.00
Concord	0	0	0	2	0	3	1	0	2	2	1	11	1.00
San Martin					1	1	0	0	3	1	0	6	0.86
Los Gatos	0	0	1	1	0	4	1	0	1	0	0	8	.73
Fremont	1	0	0	1	0	2	0	0	0	1	0	5	0.45
San Jose East (Burbank)	1	0	0	1	0							2	0.40
Gilroy	0	1	0	0	0	1	0	0	2	0	0	4	0.36
San Jose – Alum Rock	0	0	1	0	0	3	0	0	0	0	0	4	0.36
Bethel Island	0	0	0	0	0	1	1	0	0	1	0	3	0.27
Fairfield	0	0	0	1	0	1	0	0	0	1	0	3	0.27
Hayward	0	0	1	0	0	2	0	0	0	0	0	3	0.27
San Leandro	0	0	0	0	0	3	0	0	0	0	0	3	0.27
Napa	0	0	0	0	0	1	0	0	1	0	0	2	0.18
San Jose – 4th Street	0	0	0	0	0	1	0	0	1	0	0	2	0.18
Pittsburg	0	0	0	1	0	0	0	0	0	0	0	1	0.09
Redwood City	0	0	0	0	0	1	0	0	0	0	0	1	0.09
Vallejo	0	0	0	0	0	1	0	0	0	0	0	1	0.09
Mountain View	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Oakland	0	0	0	0	0	0	0	0	0	0	0	0	0.00
San Francisco	0	0	0	0	0	0	0	0	0	0	0	0	0.00
San Pablo	0	0	0	0	0	0	0	0	0	0	0	0	0.00
San Rafael	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Santa Rosa	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Any Bay Area Monitoring Site*	2	2	2	3	2	11	8	0	8	3	0	3	

* Numbers do not sum since an exceedance may occur at multiple sites on a single day.

Source: Bay Area Air Quality Management District, 2001.

Carbon Monoxide

CO is an odorless and invisible gas. It is a non-reactive pollutant that is a product of incomplete combustion. Carbon monoxide is a localized pollutant and the highest concentrations are found near the source. Ambient carbon monoxide concentrations generally follow the spatial and temporal distributions of vehicular traffic and are influenced by wind speed and atmospheric mixing. Carbon monoxide concentrations are highest in flat areas on still winter nights, when temperature inversion traps the carbon monoxide near the ground. When inhaled at high concentrations, carbon monoxide reduces the oxygen-carrying capacity of the blood, which, in turn, results in reduced oxygen reaching parts of the body. Most of the Bay Area's carbon monoxide comes from on-road motor vehicles, although a substantial amount also comes from burning wood in fireplaces.

Particulate Matter

Particulate matter in the atmosphere results from many kinds of dust- and fume-producing industrial and agricultural operations, fuel combustion, and atmospheric reactions. The Bay Area experiences its highest particulate matter concentrations in the winter, especially during evening and night hours. These particles are small and can be blown for distance by winds and subsequently inhaled into the air passages and the lungs. In this location the small particles can contribute to asthma attacks and chronic respiratory disease in some individuals (the elderly and very young are particularly susceptible). PM_{10} consists of particulate matter that is 10 microns or less in diameter (a micron is one-millionth of a meter). Major sources of PM_{10} include wood smoke, combustion of fossil fuels, and airborne dust propelled in the air by motor vehicles and construction, and diesel exhaust from trucks and buses. Some sources of particulate matter, such as demolition and construction activities, are more local in nature, while others, such as vehicular traffic, have a more regional effect.

The Bay Area Air Quality Management District (BAAQMD) estimates that up to 40 percent of the fine particulates in the Bay Area are produced by mobile sources of all types. Diesel exhaust is a growing concern as the CARB has identified diesel particulate engine matter as a toxic air contaminant. The exhaust from diesel engines includes hundreds of different gaseous and particulate components, many of which are toxic. Studies show that diesel particulate matter concentrations are much higher near heavily traveled highways and intersections.

Prior to listing of diesel exhaust as a toxic air contaminant, California had already adopted regulations that reduce diesel emissions. These regulations included new standards for diesel fuel, emission standards for new diesel trucks, buses, autos and utility equipment, and inspection and maintenance requirements for heavy-duty vehicles. Following the listing of diesel engine particulate as a toxic air contaminant, CARB is considering additional requirements for diesel fuel and engines.

Toxic Air Contaminants

The combustion process in internal combustion engines produces small amounts of chemicals identified as toxic air contaminants, some of which are related to cancer risk. Of the toxic contaminants which are regularly monitored, 1,3-butadiene and benzene contribute about 60 percent of the estimated cancer risk, and motor vehicles account for over half of these emissions. The risk of cancer from these chemicals is estimated to have been significantly reduced in recent years due to the introduction of “Phase 2” reformulated gasoline which began in 1996. For example, the average monitored ambient benzene levels for 1999 are about 60 percent lower than those observed five years earlier. Concentrations of both chemicals would be expected to decline further in the future, although more gradually, due to the continuous fleet turnover and increased population of low emission vehicles in the fleet.

Likely areas of elevated toxics concentrations would be downwind of heavily traveled roads or other major traffic generators; however, these chemicals are also dispersed regionally by wind.

AIR POLLUTION CONTROL AGENCIES

The MTC region encompasses the San Francisco Bay Air Basin in its entirety and portions of both the North Coast Air Basin and the Sacramento Valley Air Basin. Northern Sonoma County is within the North Coast Air Basin, while eastern Solano County is within the Sacramento Valley Air Basin. (Both southern Sonoma County and western Solano County are within the San Francisco Bay Air Basin.)

The Bay Area Air Quality Management District (BAAQMD) governs the San Francisco Bay Air Basin, while the Northern Sonoma County Air Pollution Control District (NSCAPCD) governs the North Coast Air Basin and the Yolo-Solano Air Pollution Control District (YSAPCD) governs the Sacramento Valley Air Basin portion that corresponds to MTC's jurisdiction. The geographic boundaries of these air basins and air districts are shown in Figure 2.2-1. In California, air pollution control districts generally follow county boundaries. In the more urban areas, county agencies were merged by state legislation into unified air quality management districts.

POLICY REQUIREMENTS AND BAY AREA ATTAINMENT STATUS

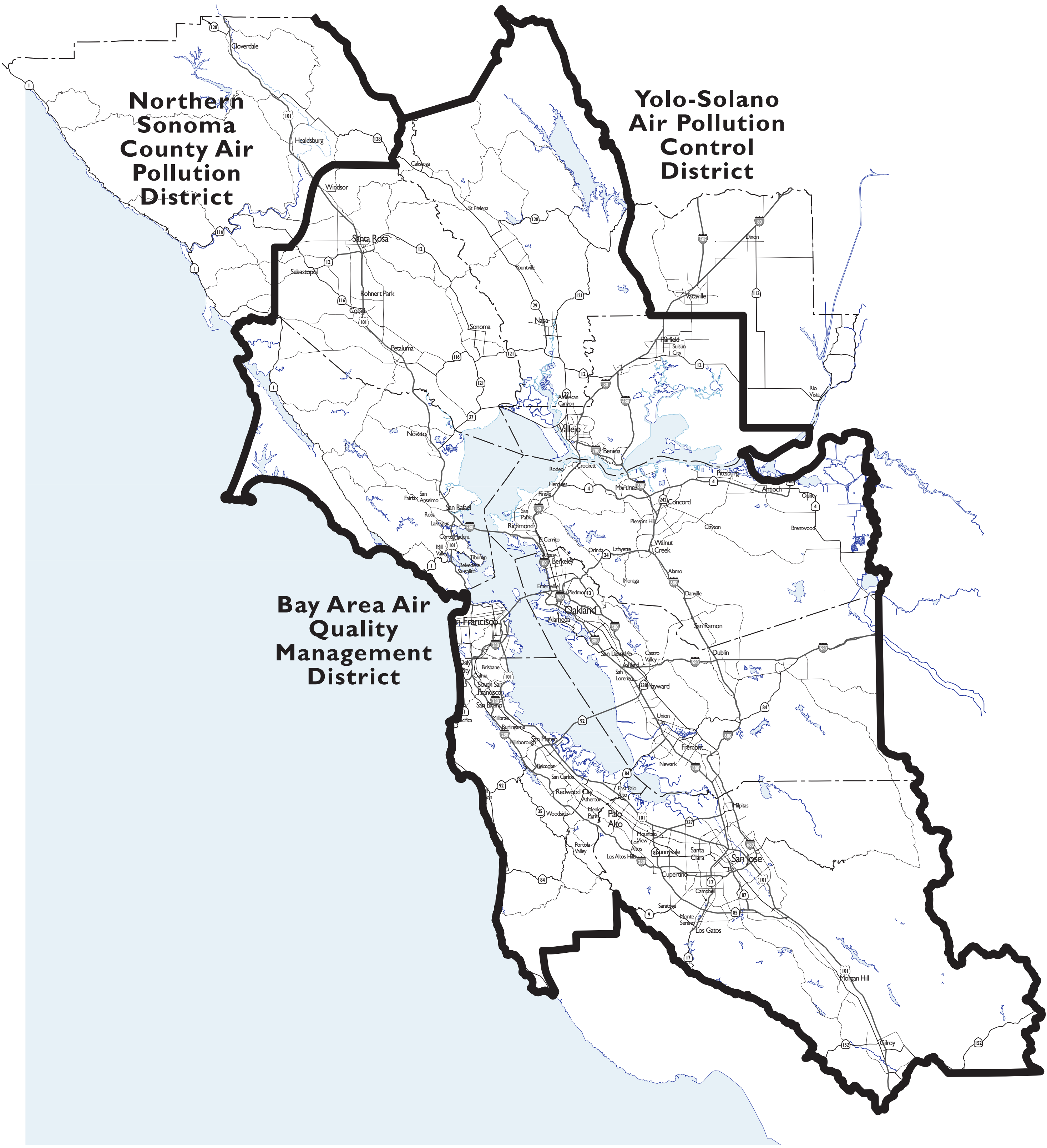
FEDERAL OZONE REQUIREMENTS AND ATTAINMENT STATUS

On May 25, 1995, the Bay Area was classified as an ozone maintenance area, having attained the 1-hour national ozone standard for five years (1990-1994). However, on July 10, 1998 the U.S. Environmental Protection Agency (EPA) published a Notice of Final Rulemaking redesignating the Bay Area as an ozone non-attainment (unclassified) area based on the current 1-hour national ozone standard. This action was due to violations of the 1-hour standard that occurred during the summers of 1995 and 1996, and became final on August 10, 1998. Redesignation required that the Bay Area demonstrate compliance with the current (0.12 ppm) national 1-hour ozone standard by November 15, 2000. The three regional agencies (which serve as "co-lead" agencies for federal air quality planning purposes)—BAAQMD, Association of Bay Area Governments (ABAG), and MTC—were required to adopt actions and control strategies to achieve compliance.

The three regional agencies submitted the new *San Francisco Bay Area Ozone Attainment Plan for the 1-Hour National Ozone Standard* to the U.S. EPA in June 1999. However, on March 30, 2001, the U.S. EPA published a *Federal Register* notice proposing a finding of failure to attain and partial approval and disapproval of the 1999 Plan, based on monitoring data at the Livermore site. As a result, the three regional agencies initiated a new planning process to attain the federal standard by 2006 and supplement the 1999 Plan. In addition to a set of 28 transportation control measures (TCMs) intended to reduce emissions from on road vehicles and are included as commitments in prior air quality plan, five new TCMs were added and several measures were

Figure 2.2-1

Bay Area Air Quality Management District Boundaries



identified for further study. Table 2.2-2 lists the existing TCMs and Table 2.2-3 lists the proposed TCMs and Further Study Measures. The new *2001 Ozone Attainment Plan* was approved by the three co-lead agencies in July 2001, and submitted to the California Air Resource Board (CARB). As of this writing, CARB has not acted upon the *2001 Ozone Attainment Plan*.

Table 2.2-2: Transportation Control Measures (TCMs) in the State Implementation Plan

TCM	*Description*
Original TCMs from 1982 Plan	
TCM 1	Reaffirm Commitment to 28 percent Transit Ridership Increase Between 1978 and 1983
TCM 2	Support Post-1983 Improvements in the Operators' Five-Year Plans and, After Consultation with the Operators, Adopt Ridership Increase Target for the Period 1983 through 1987
TCM 3	Seek to Expand and Improve Public Transit Beyond Committed Levels
TCM 4	High Occupancy Vehicle (HOV) Lanes and Ramp Metering
TCM 5	Support RIDES Efforts
TCM 6*	Continue Efforts to Obtain Funding to Support Long Range Transit Improvements
TCM 7	Preferential Parking
TCM 8	Shared Use Park and Ride Lots
TCM 9	Expand Commute Alternatives Program
TCM 10	Information Program for Local Governments
TCM 11**	Gasoline Conservation Awareness Program (GasCAP)
TCM 12**	Santa Clara County Commuter Transportation Program
Contingency Plan TCMs	
TCM 13	Increase Bridge Tolls to $1.00 on All Bridges
TCM 14	Bay Bridge Surcharge of $1.00
TCM 15	Increase State Gas Tax by 9 Cents
TCM 16*	Implement MTC Resolution 1876, Revised — New Rail Starts
TCM 17	Continue Post-Earthquake Transit Services
TCM 18	Sacramento-Bay Area Amtrak Service
TCM 19	Upgrade Caltrain Service
TCM 20	Regional HOV System Plan
TCM 21	Regional Transit Coordination
TCM 22	Expand Regional Transit Connection Ticket Distribution
TCM 23	Employer Audits
TCM 24	Expand Signal Timing Program to New Cities
TCM 25	Maintain Existing Signal Timing Programs
TCM 26	Incident Management on Bay Area Freeways
TCM 27	Update MTC Guidance on Development of Local TSM Programs
TCM 28	Local Transportation Systems Management (TSM) Initiatives

*Proposed for deletion from ozone plan
**Proposed for deletion from ozone plan, but not carbon monoxide maintenance plan.

Source: Bay Area Air Quality Management District, 2001; MTC, 2001.

Table 2.2-3: Proposed Transportation Control Measures To Be Added in 2001 Ozone Attainment Plan

TCM #	*Control Measure Description*
TCM A	Regional Express Bus Program
TCM B	Bicycle/ Pedestrian Program
TCM C	Transportation for Livable Communities (TLC)/Housing Incentive Program
TCM D	Additional Freeway Service Patrol
TCM E	Transit Access to Airports
Further Study Measures	
FS 1	Study Potential for Accelerating Particulate Trap Retrofit Program for Urban Buses
FS 2	Update MTC High Occupancy Vehicle (HOV) Lane Master Plan
FS 3	Study Air Quality Effects of High Speed Freeway Travel
FS 4	Evaluate Parking Charge Incentive Program
FS 5	Enhanced Housing Incentive Program/Station Access Program
FS 6	Further Smog Check Program Improvements

Source: Bay Area Air Quality Management District and Metropolitan Transportation Commission, 2001

In July 1997, U.S. EPA also revised the national ozone standard from the 1-hour standard noted above to a new eight-hour standard of 0.08 parts per million (ppm). During 1997, 1998, and 1999, some Bay Area monitoring sites recorded concentrations that exceeded the proposed standard. Therefore, in March 2000, the CARB recommended a nonattainment designation for the Bay Area for the proposed national 8-hour standard. The BAAQMD expects to prepare a plan to address the proposed national standard, but the schedule and requirements depend on the outcome of litigation before the U.S. Supreme Court.[3]

Federal CO Requirements and Attainment Status

In August 1998, the Bay Area was redesignated to a "maintenance area" for the national 8-hour carbon monoxide standard, having demonstrated attainment of the standards. As a maintenance area, the region must assure continued attainment of the CO standard.

Federal PM_{10} Requirements and Attainment Status

While monitoring data show the Bay Area is complying with the current national PM_{10} standard, the Bay Area has not been designated or classified with regard to this pollutant. However, as with ozone, the U.S. EPA has promulgated new standards for particulates. In July 1997, EPA revised the primary and secondary standards for particulate matter by establishing a new annual and 24-hour $PM_{2.5}$ (very small particles less than 2.5 microns) and by changing the form of the existing 24-hour PM_{10} standard. In addition, the existing annual PM_{10} standard was retained. Legal challenges to the proposed particulate standards have delayed the designation of nonattainment areas and the preparation of attainment plans. At this time, the BAAQMD's efforts are focused on

[3] Ibid.

monitoring local ambient particulate levels, and the U.S. EPA will review the particulate standards again in 2002.[4]

Federal Transportation Conformity Requirements

The 1990 CAAA outlines requirements for ensuring that federal transportation plans, programs and projects conform to the SIP's purpose of eliminating or reducing the severity and number of violations of the national ambient air quality standards. The U.S. EPA subsequently published conformity regulations to implement the 1990 CAAA conformity requirements in November 1993, and revised them in August 1995, November 1995 and August 1997. Metropolitan Planning Organizations such as MTC are required to adopt and follow these regulations. MTC Resolution No. 3075 is the MTC resolution adopting EPA's most current regulation on conformity procedures for plans, programs and projects. These same conformity requirements are also adopted by ABAG and the BAAQMD.

These regulations and resolutions state, in part, that MTC cannot approve any transportation plan, program or project unless these activities conform to the purpose of the State Implementation Plan. "Transportation plan" refers to the RTP. "Program" refers to the Transportation Improvement Program (TIP), which is a financially realistic set of highway and transit projects to be funded over the next six years. A "transportation project" is any highway or transit improvement, which is included in the RTP and TIP and requires funding or approval from the Federal Highway Administration or the Federal Transit Administration.

The 2001 *Ozone Attainment Plan* for the 1-hour ozone standard will provide a new transportation emissions "budget" for the RTP and TIP when the U.S. EPA approves the Plan, or it deems the budget adequate. When a transportation plan or program (or amendment involving regionally significant projects) is adopted by MTC, it must be accompanied by a conformity analysis demonstrating that emissions from on road mobile sources will not exceed this budget.

Conformity regulations also require that a conformity analysis address the "timely" implementation of TCMs, to ensure that adopted measures continue to contribute their anticipated emission reductions. The results of the federal conformity analysis will be contained in an appendix of the final 2001 Regional Transportation Plan and 2001 Transportation Improvement Program.

STATE REQUIREMENTS AND ATTAINMENT STATUS

The California Air Resources Board (CARB) has established a state, health-based air quality standard for ozone at a level of 9 parts per hundred million (pphm) for a one-hour average, significantly more stringent than the national standard of 12 pphm. Under the California Clean Air Act (CCAA) of 1988, the Bay Area Air Quality Management District is required to prepare a *Clean Air Plan* (CAP) to achieve state standards for ozone. The Act requires air districts to adopt, implement, and enforce TCMs. TCMs are defined in State law as any strategy to reduce vehicle

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[4] Ibid.

trips, vehicle use, vehicle miles traveled, vehicle idling, or traffic congestion for the purpose of reducing motor vehicle emissions. The 2000 CAP's TCM plan contains 19 measures, as shown in Table 2.2-4.

Table 2.2-4: Transportation Control Measures in the Clean Air Plan

TCM 1: Support Voluntary Employer Based Trip Reduction Programs
TCM 2: Adopt Employer-Based Trip Reduction Rule (DELETED)
TCM 3: Improve Areawide Transit Service
TCM 4: Improve Regional Rail Service
TCM 5: Improve Access to Rail and Ferries
TCM 6: Improve Interregional Rail Service
TCM 7: Improve Ferry Service
TCM 8: Construct Carpool/Express Bus lanes on Freeways
TCM 9: Improve Bicycle Access and Facilities
TCM 10: Youth Transportation (includes Clean Fuel School Buses)
TCM 11: Install Freeway/ Arterial Metro Traffic Operations System
TCM 12: Improve Arterial Traffic Management
TCM 13: Transit Use Incentives
TCM 14: Improve Rideshare/Vanpool Services and Incentives
TCM 15: Local Clean Air Plans, Policies and Programs
TCM 16: Intermittent Control Measure/Public Education
TCM 17: Conduct Demonstration Projects
TCM 18: Transportation Pricing Reform
TCM 19: Advocate Planning and Design of Projects to Facilitate Pedestrian Travel
TCM 20: Promote Traffic Calming

Source: Bay Area Air Quality Management District and Metropolitan Transportation Commission, 2001

The CAP was originally adopted in 1991 to satisfy this requirement. The CAP must be updated every three years, and was last revised in December 2000. At this time, no major metropolitan area in the state complies with the state ozone standard. The CCAA of 1988 requires a reduction in district wide emissions of 5 percent per year for each non-attainment pollutant or its precursors. If a district is unable to achieve this reduction, it allows, as an alternative strategy, the implementation of all feasible measures on an expeditious schedule. The Bay Area has proceeded under the latter requirement. The CCAA states that attainment plans should emphasize reducing emissions from transportation and area wide sources. The Bay Area attained the state carbon monoxide (CO) standard in 1993, so the CCAA planning requirements for CO nonattainment areas no longer apply to the Bay Area.

The Bay Area does not attain the state PM_{10} standards, which are much stricter than the national PM_{10} standards. However, at this time the CCAA does not include any planning requirements for PM_{10} non-attainment areas, so no attainment plan has been developed for this pollutant. Table 2.2-5 outlines the national and California ambient air quality standards and the Bay Area attainment status for ozone, carbon monoxide, and PM_{10}.

Table 2.2-5: Ambient Air Quality Standards for Criteria Pollutants

Pollutant	*Averaging Time*	*California Standard*	*Bay Area Attainment Status for California Standard*	*Federal Primary Standard*	*Bay Area Attainment Status for Federal Standard*	*Major Pollutant Sources*
Ozone	8 hour	---	---	0.08 ppm	Unclassified	Motor vehicles, Other mobile sources, combustion, industrial and commercial processes
	1 hour	0.09 ppm	Non-Attainment	0.12 ppm	Non-Attainment	
Carbon Monoxide	8 hour	9.0 ppm	Attainment	9 ppm	Maintenance	Internal combustion engines, primarily gasoline-powered motor vehicles
	1 Hour	20 ppm	Attainment	35 ppm	Attainment	
Particulate Matter (PM_{10})	Annual Arithmetic Mean	---	---	50 $\mu g/m^3$	Unclassified	Dust- and fume-producing industrial and agricultural operations, combustion, atmospheric photochemical reactions, and natural activities (e.g., wind-raised dust and ocean sprays)
	Annual Geometric Mean	30 $\mu g/m^3$	Non-Attainment	---	---	
	24 hour	50 $\mu g/m^3$	Non-Attainment	150 $\mu g/m^3$	Unclassified	
Particulate Matter ($PM_{2.5}$)	24 hour	---	---	65 $\mu g/m^3$	Unclassified	Same as above

Note: ppm=parts per million; mg/m^3=milligrams per cubic meter; and $\mu g/m^3$=micrograms per cubic meter

Source: Bay Area Air Quality Management District, 2001; California Air Resource Board, 2001.

OTHER IMPACTS: BAY AREA AIR QUALITY MANAGEMENT DISTRICT (BAAQMD) CEQA GUIDELINES

The BAAQMD in its April 1996 CEQA Guidelines states that plans must show over the planning period that:

- Population growth for the jurisdiction will not exceed the values included in the current State Clean Air Plan (1997)
- The rate of increase in VMT for the jurisdiction is equal to or lower than the rate of increase in population.

The BAAQMD criterion that population growth will not exceed the values included in the Clean Air Plan (CAP) is not consistent with current planning assumptions which supersede those in the CAP. The population estimates used in the most recent CAP (ABAG's *Projections '98*) are older than those used for the 2001 RTP (*Projections 2000*). Future updates of the CAP will bring the demographic projections up to date with those currently being used for regional planning and which are consistent with local policy.

The second criterion cannot be achieved for any metropolitan area with a healthy economy, which is the case in the Bay Area. While vehicle miles of travel are expected to slow in terms of year-to-year growth rates, population is projected by ABAG to grow by 19 percent over a 25-year period, employment by 33 percent, causing total VMT to grow by 48.5 percent over the same time period. However, what is more relevant for ozone and carbon monoxide is the fact that emissions are projected to decline substantially over the forecast period, in spite of growth in VMT, due to stringent state controls on automobile engines and fuels. Thus air quality trends are not coupled directly to VMT growth except for PM_{10}, which is discussed later on.

RELATIONSHIP BETWEEN RTP-LEVEL AND PROJECT-LEVEL EMISSIONS

The emissions changes discussed in this EIR are for the 2001 RTP as a whole. This EIR does not examine effects on emissions (primarily project-level CO and PM_{10}) of the individual transportation improvements in the 2001 RTP. It is possible that individual transportation improvements could result in short-term construction related emissions, due to rerouting traffic such that traffic and emissions increase in some locations when compared to 1990 base case or the No Project Alternative. However, this issue will be examined in project-level EIRs prepared in order to approve the individual projects.

RELATIONSHIP BETWEEN EIR AIR QUALITY ANALYSIS AND RTP CONFORMITY ANALYSIS

Under U.S. EPA rules and regulations, the 2001 RTP is subject to an air quality "conformity" analysis. An air quality conformity analysis tests CO and ozone precursor emissions from the 2001 RTP against conformity "budgets" as defined in U.S. EPA-approved CO and ozone attainment plans. MTC and project sponsors cannot implement certain transportation projects unless they come from an approved and conformed transportation plan. The purpose of conformity is to ensure that the 2001 RTP helps achieve and maintain Federal ozone and CO standards. For CO, the CO budget is identified in the 1994 Maintenance Plan. For the ozone precursor emissions ROG and NO_X, the applicable emission budgets are contained in the 1994 Maintenance Plan, which is currently being updated in the new *2001 Ozone Attainment Plan*. The analysis in this EIR is intended to demonstrate compliance with CEQA and is not an air quality conformity analysis.

CRITERIA OF SIGNIFICANCE

According to the State CEQA Guidelines, significant impacts to air quality would occur if the plan would: conflict with or obstruct implementation of the applicable air quality attainment plan; violate any air quality standard or contribute to an existing or projected air quality violation; or result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors). The most straightforward means to assess these potential impacts is to evaluate overall mobile source emission trends.

The following criterion will be used to assess whether proposed improvements in the 2001 RTP would have a significant adverse effect on air quality for criteria air pollutants:

- **Criterion 1: Motor vehicle emissions that are higher for the proposed 2001 RTP than for the No Project Alternative.** Implementation of the 2001 RTP would have a potentially significant impact if motor vehicle emissions for criteria pollutants ROG, NO_X, PM_{10}, and CO are higher for the Project Alternative (2001 RTP) than for the No Project Alternative.

For the purposes of addressing cumulative impacts in CEQA, it is considered a significant cumulative impact if future emissions are above today's levels and the increase is primarily related to travel demand increases due to regional growth. Travel activity and emission estimates are shown in Tables 2.2-6 through 2.2-8.

METHOD OF ANALYSIS

The air quality analysis is based on the forecasts of travel behavior from MTC's travel demand forecasting models. These models have been extensively reviewed and refined in connection with their application to air quality analyses of various kinds. Key outputs for the use in the air quality analysis include: total daily vehicle trips, vehicle miles of travel, and distribution of vehicle miles of travel by speed. This information is then fed into various air quality models maintained by the CARB.

In particular, the CARB is responsible for developing updated vehicle emission rates based on the latest testing of in-use vehicles. This program is called "EMFAC", the latest version of which was released for the Bay Area on April 4, 2001. EMFAC consists of two major parts: EMFAC and BURDEN. EMFAC calculates emission rates for a variety of vehicle types (passenger cars, trucks, etc.) by fuel usage, control technology and mode of operation (e.g., hot start, cold start). It also accounts for vehicle age, and operating conditions such as speed and temperature. Emission factors are produced for summer and winter operations to reflect the type of fuel in use, such as wintertime oxygenated fuel and summertime fuel, which has lower volatility than winter. Expected emission reductions resulting from California's Inspection and Maintenance ("Smog Check") program are incorporated within EMFAC.

Another model, BURDEN, uses emission factors from EMFAC and a large database of vehicle activity for each county to calculate total daily emissions. The activity is in the form of number of in-use vehicles, number of vehicle engine starts and vehicle miles traveled (VMT) for each vehicle type, as shown in Table 2.2-6. Vehicle population is derived from the Department of Motor Vehicle (DMV) data and number of engine starts is based on the population data and CARB guidelines. Growth factors for vehicle trips and vehicle miles of travel are derived from MTC travel forecasts. For estimates of entrained road dust—a component of PM 10—a factor of .4 grams/VMT was used based on direction from the BAAQMD.

Table 2.2-6: Travel Data

	1990	*1998*	*2025 No Project*	*2025 Project*	*Percent Change 1998 to Project A*	*Percent Change No Project to Project A*
Vehicles in Use	4,676,474	5,108,827	6,283,257	6,283,257	23.0	0
Average Daily VMT (000's)	107,707	128,369	191,768	190,587	48.5	(0.6)
Engine Starts (000's)	18,283	21,264	27,777	27,726	30.4	(0.2)
Population	6,023,577	6,716,090	8,224,108	8,224,108	22.5	NA
Employment	3,206,073	3,504,118	4,906,829	4,906,829	40.0	NA

Source: Metropolitan Transportation Commission, 2001

Table 2.2-7: Emission Estimates for the 2001 RTP (Project A and Project B)

	2025 Project (Project A)[1]	*Project B*[2]
CO	779.3	777.4
ROG	48.8	46.5
NO_X	146.3	147.4
PM_{10}	91.4	91.3

[1] Includes federal New Starts fun ding and the BART to San Jose and Muni Metro Chinatown subway projects.
[2] Does not include federal New Starts fun ding and the BART to San Jose and Muni Metro Chinatown subway projects.

Source: Metropolitan Transportation Commission, 2001.

To identify the incremental impact of the proposed 2001 RTP, projected vehicle emissions for each of the criteria pollutant (ROG, NO_X, CO, and PM_{10}) for the No Project Alternative were compared to the Project Alternative in 2025.

Projected vehicle emissions for the year 2025 without the 2001 RTP—the No Project Alternative—were also compared to existing conditions to identify the change in air quality attributable to cumulative impacts.

SUMMARY OF IMPACTS

DIRECT IMPACTS

As shown in the Table 2.2-8 at the regional level, transportation emissions for all criteria pollutants are lower in the Project Alternative than in the No Project Alternative. Thus, based on this analysis, there is no significant air quality impacts from implementation of the proposed 2001 RTP relative to criterion of significance.

CUMULATIVE IMPACTS

As shown in Table 2.2-8, emissions for CO, ROG, and NO_X decrease substantially between the 1998 Base and the 2025 horizon year of 2001 RTP. The major reason for this decrease is turnover in autos whereby older polluting cars are retired and replaced with newer and substantially less polluting cars. These trends are the effect of the stringent emission controls CARB has adopted for new engines and fuels. On the other hand, PM_{10} emissions increase compared to current conditions, because they are strongly influenced by growth in vehicle miles or travel, with lesser contributions from tire and brake wear and exhaust. (It should be noted that while projected VMT is increasing, the rate of increase is lower than in the recent past: 1.47 percent compounded per year from 1998 to 2025, compared to 2.22 percent between 1990 and 1998). These are largely cumulative impacts because the Project Alternative produces lower emissions than the No Project Alternative.

Table 2.2-8: Emission estimates using EMFAC 7G Factors[1]

Pollutant	*1998*	*2025 No Project*	*2025 Project*	*Percent Change 1998 to Project*	*Percent Change No Project to Project A*
ROG	178.4	49.3	46.8	(73.8)	(5.1)
CO	2,044.4	795.3	779.3	(61.9)	(2.0)
NOX	251.4	146.5	146.3	(41.8)	(0.1)
PM_{10}[2]	64.0	91.9	91.4	42.8	(0.5)

[1] EMFAC 7G latest emissions model available to MTC for purposes of EIR impact assessment. Future conformity analyses will use EMFAC 2000 data provided by CARB along with CARB VMT estimates.
[2] Tire wear, brake wear, exhaust and .4 grams/mile entrained dust (as used by BAAQMD)

Source: Metropolitan Transportation Commission, 2001.

SIGNIFICANCE OF IMPACTS AND MITIGATION MEASURES

IMPACT

2.2-1 Emissions impacts for the Project Alternative for CO, ROG, and NO_X are not considered to be significant, since they are lower than today's emissions by substantial amounts.

MITIGATION MEASURES

Not applicable as there is no significant impact from the implementation of the 2001 RTP.

CUMULATIVE IMPACT

2.2-2 PM_{10} emissions are projected to increase substantially due to projected regional growth and the attendant increase in travel. This is considered a cumulative impact.

MITIGATION MEASURES

The 2001 RTP reduces PM-10 emissions relative to the No Project Alternative. Thus, implementation of the 2001 RTP is a measure to mitigate the environmental impact due to growth in PM-10 since it includes programs and projects that can reduce the growth in VMT. Further, if a Federal PM-10 attainment plan is required in the future, then MTC will identify appropriate control measures for PM-10 emissions.

SIGNIFICANCE AFTER MITIGATION

This mitigation measure would be expected to further reduce PM-10 emissions relative to the No Project Alternative to a less-than-significant level.

2.3 Energy

This section discusses the energy impacts of implementing transportation improvements in the proposed 2001 RTP. Issues related to energy use include levels of consumption of non-renewable energy sources for construction and personal and commercial transportation.

Transportation energy use is related to the following factors: the efficiency of cars, trucks and public transportation, choice of different travel modes (auto, carpool, and public transit), and miles traveled by these modes. Energy is also consumed with ongoing and routine operation and maintenance of the transportation infrastructure.

Also because of concerns with increasing concentrations of greenhouse gases in the atmosphere, such as carbon dioxide, this section evaluates trends in these emissions as well.

SETTING

Current annual energy consumption in the United States is approximately 94,000,000 billion British thermal units (Btu)[1], which represents approximately one-quarter of the world's energy consumption. Within California, transportation is the major end use of energy, accounting for approximately 46 percent of total energy consumption.[2] Nonrenewable energy products derived from crude oil, including gasoline, diesel, kerosene, and residual fuel, provide nearly all of the energy consumed in transportation. The long-term oil supply outlook for California is one of declining in-state and Alaska supplies leading to increasing dependence on foreign oil sources.

The transportation sector currently consumes relatively minor amounts of natural gas or electricity; however, air quality laws and regulations, are likely to result in increased use of compressed natural gas and electricity in the future. The California Energy Commission predicts that potential annual statewide consumption of natural gas for transportation purposes could increase from approximately 33 million therms in 2000 to a range of 80 to 90 million therms over the next 15 to 20 years[3]. Electricity consumption for transportation purposes could potentially increase from 494 million kWh in 2000 to a range of 670 to 746 million kWh over that same period.

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[1] The units of energy used in this report are British thermal units (Btu), kilowatt-hours (kWh), therms, and gallons. A Btu is the quantity of heat required to raise the temperature of 1 pound of water 1 degree Fahrenheit at sea level. Since the other units of energy can all be converted into equivalent British thermal units, the Btu is used as the basis for comparing energy consumption associated with different resources. A kWh is a unit of electrical energy, and one kWh is equivalent to approximately 10,200 Btu, taking into account initial conversion losses (i.e., from one type of energy, such as chemical, to another type of energy, such as mechanical) and transmission losses. Natural gas consumption typically is described in terms of cubic feet or therms; 1 cubic foot of natural gas is equivalent to approximately 1,050 Btu, and 1 therm represents 100,000 Btu. One gallon of gasoline/diesel is equivalent to approximately 140,000 Btu, taking into account energy consumed in the refining process.

[2] California Energy Commission (CEC). California Energy Outlook 2000, Volume II, Transportation Energy Systems, August 2000.

[3] Ibid.

Table 2.3-1 provides estimated 2000 transportation energy consumption in California and compares statewide totals with the corresponding values for the Bay Area. As shown in Table 2.3-1, motor vehicles account for the bulk of total transportation energy consumption in the Bay Area. Electricity consumption for Bay Area transportation purposes is substantial, at 416 million kWh per year or 80 percent of the statewide transportation demand. The cost and availability of electricity has become a critical issue in California and could affect the operating costs of those transit systems dependent on electricity for propulsion (BART, light rail, and potentially Caltrain in the future). Natural gas consumption is approximately 5 million therms per year, which is relatively minor.

Table 2.3-1: Transportation Energy Consumption in California and the Bay Area (2000)

Annual Consumption in Energy Resource Units			
Fuel Type	*Units*	*State*	*Bay Area*
Gasoline / Diesel	million gallons	14,378	3,159
Electricity	million kWh	505	416
Natural Gas	million therms	34	5

Source: California Department of Transportation, California Motor Vehicle Stock, Travel and Fuel Forecast*, November 2000; California Energy Commission,* On-Road & Rail Transportation, Energy Demand Forecasts for California*, April 1999; Environmental Science Associates, 2001.*

ENERGY EFFICIENCY BY TRANSPORTATION MODE

Long-term energy consumption trends for transportation will be largely determined by fuel efficiency trends for motor vehicles, since motor vehicles are the predominant transportation mode for passengers and commercial goods. The federal Energy Policy and Conservation Act established the first fuel economy standards for on-road motor vehicles in the U.S. Pursuant to the Act, the National Highway Traffic and Safety Administration, which is part of the U.S. Department of Transportation, is responsible for establishing vehicle standards and for revising existing standards. Since 1990, the fuel economy standard for new passenger cars has been 27.5 miles per gallon (mpg). Since 1996, the fuel economy standard for new light trucks (gross vehicle weight of 8,500 pounds or less) has been 20.7 mpg. Heavy-duty vehicles (i.e., vehicles and trucks over 8,500 pounds gross vehicle weight) are not currently subject to fuel economy standards.

Compliance with federal fuel economy standards is not determined for individual vehicle model, but rather on the basis of the average fuel economy of a manufacturer’s vehicles produced for sale in the U.S. The Corporate Average Fuel Economy (CAFE) program, which is administered by U.S. Environmental Protection Agency, was created to determine vehicle manufacturers’ compliance with the fuel economy standards. The U.S. Environmental Protection Agency calculates a CAFE value for each manufacturer based on city and highway fuel economy test results and vehicle sales. The U.S. Department of Transportation is authorized to assess penalties against car manufacturers for noncompliance based on information generated under the CAFE program.

Model year 2000 cars had the lowest recorded fuel economy ratings since 1980, largely due to buyer preferences for sport utility vehicles (21 percent of new car sales in the US). Since 1981 improved engine performance has largely been offset by an increase in the average weight of cars and light duty trucks (10 percent and 16 percent, respectively).

Based on recent trends, this EIR assumes that the energy efficiency of cars will not advance significantly, essentially a worst case assumption (although there are certainly technologies available that could make large strides toward greater efficiency, such as the hybrid models). The overall energy efficiency estimated for the entire vehicle fleet today is 22 mpg, remaining constant for the forecast period.

ENERGY USED BY PUBLIC TRANSIT

Public Transit energy consumption includes energy consumed for operation of public buses and ferries, electrified rail systems, and ferries. Using statistics developed by the American Public Transit Association, the generalized energy factors for different types of transit service are provided in Table 2.3-2 below.

Table 2.3-2: Energy Factors of Transit Service

Service	*Energy Factor (BTU/Vehicle Mile)*
Bus	36,900
Light Rail	101,100
Rapid Rail	72,200
Commuter Rail	98,700
Ferry	1,200,000

Source: American Public Transit Association; MTC, 2001.

ENERGY USED BY COMMERCIAL VEHICLES

Commercial vehicles, which are generally composed of light, medium, and heavy trucks generally fueled by diesel or gasoline, are part of the general fleet mix of vehicles present within the Bay Area transportation system. Based on data for the State of California from the California Energy Commission, generalized energy factors for these types of vehicles are provided on Table 2.3-3 below:

Table 2.3-3: Energy Factors for Commercial Vehicle

Service	*Energy Factor (BTU/Vehicle Mile)*
Light-Duty Vehicles	6,091 (6,291)[1]
Medium- and Heavy-Trucks	26,260 (24,950)[1]

[1] Based on projections for Year 2001 with values in parentheses shown for Year 2020.

Source: California Energy Commission, 2000.

ENERGY USED IN CONSTRUCTION

Estimation of energy used in construction poses a complex problem. The type of project, particular construction technique, type of equipment used, and duration of construction all affect the total energy used. While Caltrans developed a number of general energy factors for different types of transportation projects in the early 80's, these factors are largely out of date. Previous work conducted for the 1998 EIR did, however, suggest that the dominant factor in calculation of daily transportation energy use is the amount of energy used by motor vehicles and public transportation representing over 95% of the calculated daily values. As a surrogate for construction energy, the EIR uses a more qualitative approach which is the relative difference in cost of the transportation improvements between alternatives.

GLOBAL WARMING

Since the beginning of the industrial revolution, atmospheric concentrations of carbon dioxide have increased nearly 30 percent, methane concentrations have more than doubled, and nitrous oxide concentrations have risen by about 15 percent. These increases contribute to the trapping of heat in the earth's atmosphere. (Water vapor in the atmosphere is also a significant source of heat trapping, and is as or more potent than carbon dioxide.) Sulfate aerosols, a common air pollutant, cool the atmosphere by reflecting light back into space; however, sulfates are short-lived in the atmosphere and vary regionally.

There is currently strong consensus among scientists that the combustion of fossil fuels and other human activities are the primary reason for the increased concentration of atmospheric carbon dioxide. Fossil fuels burned to run cars and trucks, heat homes and businesses, and provide power to factories are responsible for about 98 percent of U.S. carbon dioxide emissions, 24 percent of methane emissions, and 18 percent of nitrous oxide emissions. Increased agriculture, deforestation, landfills, industrial production, and mining also contribute a significant share of emissions.

Similar to the energy trends above, global warming emissions from carbon dioxide emitted from transportation sources will be strongly linked to the fuel efficiency of the automobile engine. The consumption of fossil fuels in transportation produces about 20 pounds of carbon dioxide for each pound of fuel consumed. In addition the generation of electricity for rail systems produces carbon dioxide, unless the source is hydro, solar, or thermal. A certain amount of electrical energy is also wasted in the transmission of the power from the generating plant to the end user.

CRITERIA OF SIGNIFICANCE

This EIR will use the following criteria to assess whether the proposed transportation improvements in the 2001 RTP will have a significant adverse effect on energy consumption:

- Criterion 1: Five percent or greater increase in energy consumption. Implementation of transportation improvements in the 2001 RTP would have a potentially significant impact if it results in a 5 percent or greater increase in energy consumption compared to the No Project scenario. Energy consumption includes that required for operation of the transportation system (private vehicles and public transit).

An increase in energy consumption due to projected increases in travel associated with future population and employment growth in the region is considered a cumulative energy impact.

METHOD OF ANALYSIS

The analysis of energy used for operation of the transportation system is based on output from MTC's travel demand model, which includes the projected use of different travel modes (transit, carpools, single occupant vehicles), and anticipated vehicle miles of travel. As explained above, average on-road vehicle fuel economy rates in California are approximately 22 miles per gallon in 2000 and are assumed to remain steady throughout the remainder of the planning period to 2025.

Transit energy consumption is also based on the rates of use for the different modes described above. In this case, the rates are applied to estimates of daily transit vehicle miles of travel developed by MTC.

Neither analysis incorporates indirect energy consumption due to production of fuel and transportation/transmission to the end users.

SUMMARY OF IMPACTS

DIRECT IMPACTS

With respect to transportation-related energy use, Table 2.3-4 presents the estimated energy use for on-road vehicles and transit systems. Total energy usage is expected to increase by 28 percent between 1998 and 2025 for both the Project and the No Project. Transit energy use is expected to increase by about 19 percent by 2025. Because the values are so close for the Project and No Project alternatives, it is possible that the higher energy use for construction in the Project alternative would make it more energy intensive than the No Project alternative. However, it is unlikely the energy differences would result in triggering a significant impact as defined by the criterion above.

Table 2.3-4: Daily Energy Use on Transportation Systems (BTUs in billions) (1998 to 2025)

Alternative	*On-Road Vehicle Use*	*Transit Use*[1]	*Total Energy*
1998	1,298	26	1,324
2025 Project	1,662	31	1,693
2025 No Project	1,672	29	1,701

[1] Derived from projected miles of travel and energy intensities for rail and ferry modes calculated from data in APTA, *2000 Public Transportation Fact Book,* March 2000.

Source: Metropolitan Transportation Commission, 2001; Environmental Science Associates, 2001.

In terms of global warming, the proposed 2001 RTP would have lower carbon dioxide emissions than the No Project alternative by about 2.3 percent (see Table 2.3-5).

Table 2.3-5: Carbon Dioxide and Energy (BTUs in billions) (1998 to 2025)

	1998	2025 No Project	2025 Project A	2025 Project B
CO_2	473.1	687.5	671.9	667.6
Energy	1,324	1,693	1,702	1,691

Source: Metropolitan Transportation Commission, 2001.

INDIRECT/CUMULATIVE IMPACTS

As mentioned above their would be indirect energy impacts from the production of fuel used in automobiles, the transportation of this fuel to the end user, and the production and transmission of electrical energy. There would also be cumulative impacts on energy consumption associated with the population and employment induced travel growth in the region between 1998 and 2025 of about 29 percent. This is higher than the population growth rate, but lower than the employment growth rate.

SIGNIFICANT IMPACTS AND MITIGATION MEASURES

According to the significance criterion, no significant impacts for the 2001 RTP can be determined compared to the No Project Alternative.

CUMULATIVE IMPACT

2.3-1 There will be a cumulative impact in energy use resulting from growth in travel between 1998 and 2025.

MITIGATION MEASURES

The cumulative impact of increased transportation energy consumption and carbon dioxide (global warming emissions) could be mitigated by Congress adopting more stringent automobile fuel standards.

SIGNIFICANCE AFTER MITIGATION

This mitigation measure is not expected to reduce this potentially significant cumulative impact on energy use to a less-than-significant-level.

2.4 Geology and Seismicity

This chapter analyzes the potential effects of the Bay Area geology and seismicity on the transportation improvements in the 2001 RTP. It generally indicates potential difficulties and hazards, such as underlying landfill or a major fault line, and provides mitigation measures that may reduce those difficulties and hazards to a less-than-significant level.

SETTING

GEOLOGY

California is divided into 11 natural regions, referred to as geomorphic provinces, based on similar physical characteristics such as relief, landforms, and geology. The Bay Area is located primarily within the Coast Range geomorphic province, with portions of Contra Costa and Solano Counties extending into the Great Valley geomorphic province.

Coast Range

The Coast Range geomorphic province extends 400 miles along the Pacific Coast, from Oregon south into Southern California. Independent and discontinuous, northwest-trending mountain ranges, ridges, and intervening valleys distinguish the Coast Range geomorphic province and generally characterize the geologic setting of the San Francisco Bay region. San Francisco Bay, which was formed within a shallow, regional structural depression, is the predominant feature, separating smaller northern and southern mountain ranges. In the southern Bay Area, the Santa Cruz Mountains border San Francisco Bay on the west, while the Berkeley Hills, an extension of the Diablo Range, are to the east. Mount Diablo marks the northern end of the Diablo Range, another discontinuous range within this province, which stretches 130 miles southward to the Kettlemen Hills at the cusp of the San Joaquin Valley. The broad, low-relief Santa Clara and San Benito Valleys lie between the Santa Cruz Mountains and the Diablo Range. In the North Bay, the rugged, mountainous character of the Marin Peninsula is dominated by Mount Tamalpais (elevation 2,604 feet above sea level).

Much of the Coast Range province is composed of marine sedimentary and volcanic rocks that form the Franciscan Assemblage, located east of the San Andreas fault. The Franciscan Assemblage in this region of California is Jurassic- to Cretaceous-age (approximately 65 to 150 million years old) and consists primarily of greenstone (altered volcanic rocks), basalt, chert (ancient silica-rich ocean deposits), and sandstone that originated as ancient sea floor sediments. The region west of the San Andreas fault is underlain by a mass of basement rock known as the "Salinian Block." This block contains igneous rocks,[1] Tertiary-age (up to 65 million years old) marine sandstone, and various metamorphic rocks[2] believed to have originated some 350 miles to

[1] Igneous rocks are those that form from molten magma, such as granite.

[2] Metamorphic rocks are sedimentary or volcanic rocks altered by prolonged heating and deformation.

the south. The Salinian Block has been moving northward along the west side of the San Andreas fault and associated rocks can be found as far north as Point Arena.

Marginal lands surrounding San Francisco Bay are generally alluvial plains of low relief that slope gently bayward from the bordering uplands and foothills. The alluvial plains that comprise the Bay margin are composed of Quaternary-age (up to 2 million years old) alluvial sediments consisting of unconsolidated stream and basin deposits. These alluvial plains terminate bayward at the tidal marshlands that surround the Bay. Marshlands are composed of intertidal deposits, including the fine-grained plastic clay known as “Bay Mud,” which, in some areas, underlies artificial fills. San Francisco Bay is originally believed to have encompassed 700 square miles, although dredging and fill operations have reduced the Bay to approximately 400 square miles. Historic shoreline reclamation resulted in the placement of varying types of man-made artificial fill that overlie intertidal deposits.

Great Valley

Portions of Solano and Contra Costa Counties are located in the Great Valley geomorphic province, which consists of a large, nearly level inland alluvial plain 400 miles in length and averaging 50 miles in width. The topography of the Great Valley is flat, but slopes gently along its eastern margin (Sierra Nevada foothills) and western margin (Coast Ranges). Sediments in the Great Valley are gravels, sands, clays, and silts that originated largely from the Sierras, with sediments from the Coast Range contributing to a lesser extent. The sediments that compose the valley floor are thick, and in some areas extend as far as 10 miles below the surface. The Great Valley Sequence, a thick section of ancient sea floor sediments extending under the Great Valley, overlies the Coast Range Franciscan Assemblage along the valley’s western flank.

Soils

A wide variety of soils form the alluvial plains bordering San Francisco Bay. Soils in the Bay Area fall within four major classifications established by the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS). Depending on localized conditions, these general classifications are grouped into more specific soil types by location, climate, and slope. The Santa Clara valley and the alluvial plains surrounding San Francisco Bay are classified as deep alluvial plain and floodplain soils. These soils occupy the valleys in areas with higher rainfall and are considered productive when drained and fertilized. Soils closer to the Bay margin are generally dark-colored clays that have a high water table or are subject to overflow from flooding. Throughout California, Bay margin soils are typically used for wheat, barley, and native pastureland. Soils at the extreme edge of San Francisco Bay have a moderate to high content of soluble salts; these soils are referred to as “alkali soils” and can be used for salt grass pasture or for production of salt-tolerant crops. Soils in northern San Mateo County, the eastern portion of the city of San Francisco, and in Marin County are classified as residual soils and are characterized by moderate depth to underlying bedrock. Residual soils are present in natural grasslands where annual rainfall is considered moderately high; these grasslands constitute some of the best natural grazing lands in California.[3]

SEISMICITY

The San Francisco Bay Area contains both active and potentially active faults and is considered a region of high seismic activity.[4] The 1997 Uniform Building Code (UBC), published by the International Conference of Building Officials, locates the entire Bay Area within Seismic Risk Zone 4. Areas within Zone 4 are expected to experience maximum magnitudes and damage in the event of an earthquake.[5] The U.S. Geological Survey (USGS) Working Group on California Earthquake Probabilities has evaluated the probability of one or more earthquakes of Richter magnitude 6.7 or higher occurring in the San Francisco Bay Area within the next 30 years. The Working Group concluded that there is currently a 70 percent likelihood of a magnitude 6.7 or higher earthquake occurring in the Bay Area by 2030.[6]

Regional Faults

The San Andreas and the Hayward faults are the two principally active, strike-slip-type faults[7] in the Bay Area and have experienced movement within the last 150 years. The San Andreas fault is a major structural feature in the region and forms a boundary between the North American and Pacific tectonic plates. Other principal faults capable of producing significant Bay Area ground shaking are listed in Table 2.4-1 and include the Calaveras fault, the Rodgers Creek Fault Zone, and the Concord–Green Valley faults, as shown on Figure 2.4-1. A major seismic event on any of these active faults could cause significant ground shaking and surface fault rupture, as was experienced during earthquakes in recent history, namely the 1868 Hayward earthquake, the 1906 San Francisco earthquake, and the 1989 Loma Prieta earthquake. The estimated magnitudes (moment) identified in Table 2.4-1 represent *characteristic* earthquakes on particular faults.[8]

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3 Division of Agricultural Science, University of California, Generalized Soil Map of California, 1951.

4 An active fault is defined by the State of California as a fault that has had surface displacement within Holocene time (approximately the last 10,000 years). A potentially active fault is defined as a fault that has shown evidence of surface displacement during the Quaternary (last 1.6 million years), unless direct geologic evidence demonstrates inactivity for all of the Holocene or longer. This definition does not mean that faults lacking evidence of surface displacement are necessarily inactive. "Sufficiently active" is also used to describe a fault if there is some evidence that Holocene displacement occurred on one or more of its segments or branches (Hart, E. W., *Fault-Rupture Hazard Zones in California: Alquist-Priolo Special Studies Zones Act of 1972 with Index to Special Studies Zones Maps,* California Division of Mines and Geology, Special Publication 42, 1990, revised 1997).

5 Lindeburg, M., Seismic Design of Building Structures: A Professional's Introduction to Earthquake Forces and Design Details, Professional Publications Inc., 1998.

6 U.S. Geological Society (USGS) Working Group on California Earthquake Probabilities (WG99), *Earthquake Probabilities in the San Francisco Bay Region: 2000-2030 – A Summary of Findings*, Open-File Report 99-517, 1999.

7 "Strike-slip" faults primarily exhibit displacement in a horizontal direction, but may have a vertical component. Right-lateral strike-slip movement of the San Andreas fault, for example, means that the western portion of the fault is slowly moving north while relative motion of the eastern side is to the south.

8 Moment magnitude is related to the physical size of a fault rupture and movement across a fault, while Richter magnitude scale reflects the maximum amplitude of a particular type of seismic wave. Moment magnitude provides a physically meaningful measure of the size of a faulting event. The concept of "characteristic" earthquake means that we can anticipate, with reasonable certainty, the actual damaging earthquakes [the size of the earthquakes] that can occur on a fault.

Table 2.4-1: Active Faults In The MTC Project Area

Fault	*Recency of Movement*	*Fault Classification*[1]	*Historical Seismicity*[2]	*Maximum Moment Magnitude Earthquake (Mw)*[3]
Hayward	1836; 1868 Holocene	Active	M6.8, 1868 Many <M4.5	7.1
San Andreas	1906; 1989 Holocene	Active	M7.1, 1989 M8.25, 1906 M7.0, 1838 Many <M6	7.9
Rodgers Creek	Historic Holocene	Active	M6.7, 1898 M5.6, 5.7, 1969	7.0
Concord–Green Valley	1955 Holocene	Active	Historic active creep	6.9
Marsh Creek-Greenville	1980 Holocene	Active	M5.6 1980	6.9
San Gregorio–Hosgri	Holocene; Late Quaternary	Active	Many M3-6.4	7.3
West Napa	Holocene	Active	NA	6.5
Maacama	Holocene	Active	NA	7.1
Calaveras	1861 Holocene	Active	M5.6-M6.4, 1861 M4 to M4.5 swarms 1970, 1990	6.8

[1] An active fault is defined by the State of California as a fault that has had surface displacement within Holocene time (approximately the last 10,000 years). A potentially active fault is defined as a fault that has shown evidence of surface displacement during the Quaternary (last 1.6 million years), unless direct geologic evidence demonstrates inactivity for all of the Holocene or longer. This definition does not, of course, mean that faults lacking evidence of surface displacement are necessarily inactive. Sufficiently active is also used to describe a fault if there is some evidence that Holocene displacement occurred on one or more of its segments or branches (Hart, 1997).

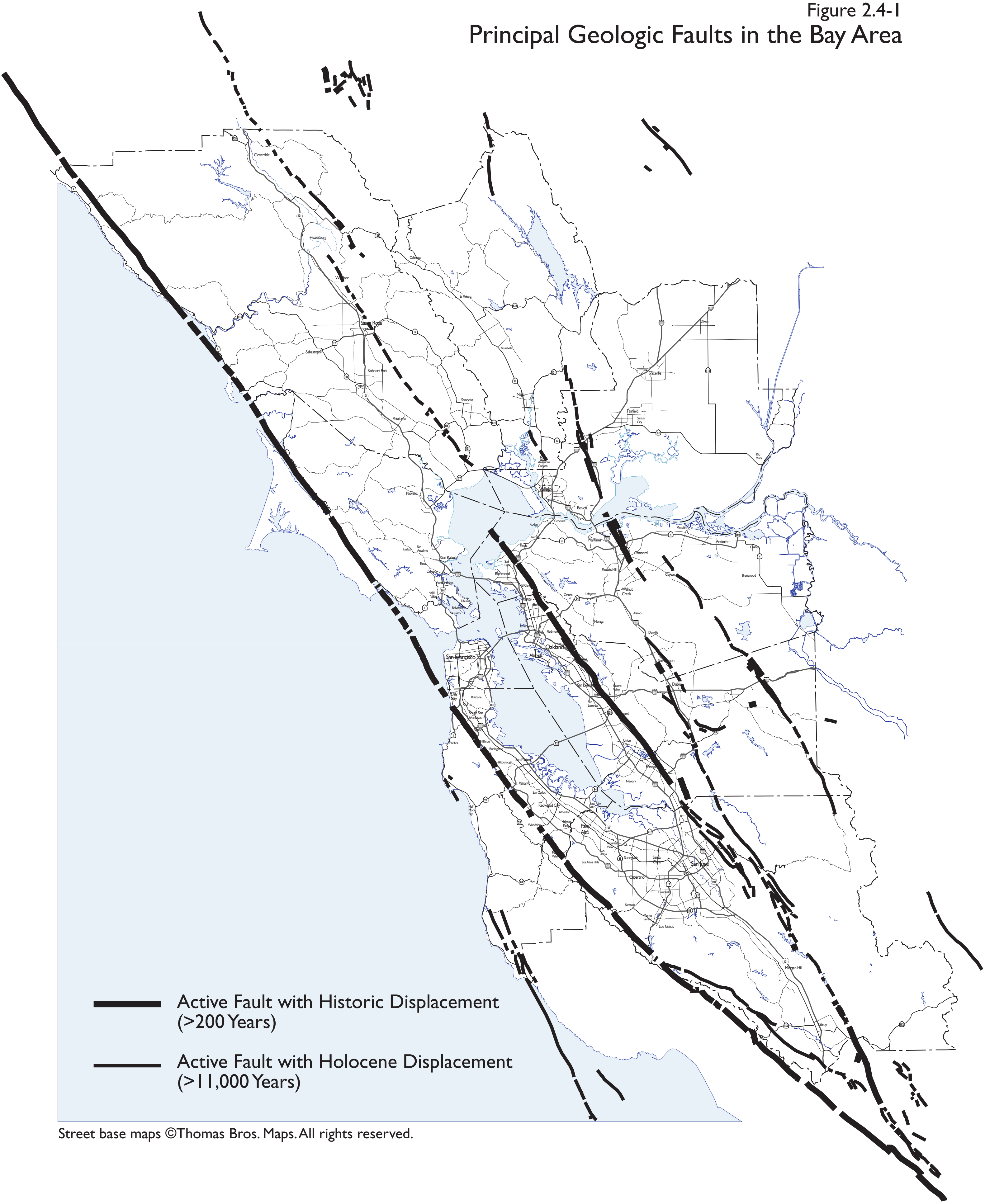
[2] Richter magnitude (M) and year for recent and/or large events. Richter magnitude scale reflects the maximum amplitude of a particular type of seismic wave.

[3] Moment magnitude is related to the physical size of a fault rupture and movement across a fault. Moment magnitude provides a physically meaningful measure of the size of a faulting event (CDMG, 1997b). The maximum moment magnitude earthquake (Mw), derived from the joint CDMG/USGS Probabilistic Seismic Hazard Assessment for the State of California, 1996. (CDMG OFR 96-08 and USGS OFR 96-706).

Sources: Derived from the USGS Earthquake Probabilities in the San Francisco Bay Region: 2000-2030 - A Summary of Findings. (USGS OFR 99-517); Hart, 1997; Jennings, 1994; Peterson, 1996.

Figure 2.4-1

Principal Geologic Faults in the Bay Area



GEOLOGIC AND SEISMIC HAZARDS

Surface Fault Rupture

Seismically induced ground rupture is defined as the physical displacement of surface deposits in response to an earthquake's seismic waves. The magnitude and nature of fault rupture can vary for different faults or even along different strands of the same fault. Future faulting is generally expected along different segments of faults with recent activity.[9] Structures, transportation facilities, and utility systems crossing fault traces are at risk during a major earthquake due to ground rupture caused by differential lateral and vertical movement on opposite sides of the active fault trace. Lateral displacement may range from a few inches to over 20 feet, as occurred in the 1906 San Francisco earthquake. Thrust faults as well as faults with strike-slip movement can have a vertical displacement component that can total several feet.

However, the exception to obvious surface displacement is the "blind-thrust" fault. The Mt. Diablo blind-thrust fault, for example, is a newly recognized earthquake source for the San Francisco Bay Region. It has been mapped on the western base of Mt. Diablo on the east side of the San Ramon Valley. The USGS Working Group on California Earthquake Probabilities recommended that this particular thrust fault be considered in their seismic probability calculations. This fault is considered a "blind thrust" because it does not exhibit a surficial expression of displacement. The Mt. Diablo thrust fault slips at a long-term rate of about 3 millimeters/year, but has not been zoned as an active fault under the Alquist-Priolo Act. [10]

Although multiple active and potentially active faults are located within the Bay Area, ground rupture is most likely to occur along active faults zoned as Earthquake Hazard Zones under mandate of the Alquist-Priolo Act. It is important to note that surface fault rupture is not necessarily restricted to the area within an Alquist-Priolo Zone. Additionally, ground rupture is possible on both active and potentially active faults not zoned as Earthquake Hazard Zones, although these faults are considered less susceptible to ground rupture hazards than the principally active faults listed in Table 2.4-1.

Ground Shaking

Strong ground movement from a major earthquake could affect the Bay Area during the next 30 years. Ground shaking may affect areas hundreds of miles distant from the earthquake's epicenter. The intensity of ground movement during an earthquake can vary depending on the overall magnitude, distance from the fault, focus of earthquake energy, and type of geologic material. Ground shaking can be described in terms of peak acceleration, peak velocity, and displacement of the ground.[11]

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[9] California Division of Mines and Geology, *Guidelines for Evaluating and Mitigation Seismic Hazards*, CDMG Special Publication 117, 1997.

[10] USGS, 1999.

[11] Peak acceleration, peak velocity, and peak displacement values were measured by strong-motion detectors during the Loma Prieta earthquake in several ground and structure strong-motion stations in the Bay Area. For comparison purposes, the maximum peak

Table 2.4-2: Modified Mercalli Intensity Scale

	Intensity Description	*Average Peak Acceleration*[1]
I	Not felt except by a very few persons under especially favorable circumstances.	<0.0015g
II	Felt only by a few persons at rest, especially on upper floors on buildings. Delicately suspended objects may swing.	<0.0015g
III	Felt quite noticeably indoors, especially on upper floors of buildings, but many persons do not recognize it as an earthquake. Standing motor cars may rock slightly. Vibration similar to a passing of a truck. Duration estimated.	<0.0015g
IV	During the day felt indoors by many, outdoors by few. At night, some awakened. Dishes, windows, doors disturbed; walls make cracking sound. Sensation like heavy truck striking building. Standing motor cars rocked noticeably.	0.015g-0.02g
V	Felt by nearly everyone, many awakened. Some dishes, windows, broken; a few instances of cracked plaster; unstable objects overturned. Disturbances of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.	0.03g-0.04g
VI	Felt by all, many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight.	0.06g-0.07g
VII	Everybody runs outdoors. Damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable in poorly built or badly designed structures; some chimneys broken. Noticed by persons driving motor cars.	0.10g-0.15g
VIII	Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Persons driving motor cars disturbed.	0.25g-0.30g
IX	Damage considerable in specially designed structures; well-designed frame structures thrown out of plumb; great in substantial buildings, with partial collapse. Buildings shifted off foundations. Ground cracked conspicuously. Underground pipes broken.	0.50g-0.55g
X	Some well-built wooden structures destroyed; most masonry and frame structures destroyed with foundations; ground badly cracked. Rails bent. Landslides considerable from riverbanks and steep slopes.	> 0.60g
XI	Few, if any, masonry structures remain standing. Bridges destroyed. Broad fissures in ground. Underground pipelines completely out of service. Earth slumps and land slips in soft ground. Rails bent greatly.	> 0.60g
XII	Practically all works of construction are damaged greatly or destroyed. Waves seen on ground surface. Lines of sight and level are distorted. Objects are thrown upward into the air.	> 0.60g

[1] Acceleration is expressed as "g," which is gravity equaling 980 centimeters per second squared. Acceleration is scaled against acceleration due to gravity or the acceleration with which a ball falls if released at rest in a vacuum (1.0 g). Acceleration of 1.0 g is equivalent to a car traveling 100 meters (328 feet) from rest in 4.5 seconds. Corresponding peak acceleration values should only be considered estimates for comparison purposes.

Source: Bolt, Bruce A., Earthquakes*, W. H. Freeman and Company, New York, 1988.*

acceleration value recorded was in the vicinity of the epicenter, near Santa Cruz, at 0.64 g. The highest value measured on the San Francisco Peninsula was 0.33 g, recorded in artificial fill soils at the San Francisco International Airport (California Division of Mines and Geology, The Loma Prieta (Santa Cruz Mountains), California, Earthquake of 17 October 1989, Special Publication 104, 1990.). Peak ground acceleration is the maximum horizontal ground movement expressed as acceleration due to gravity, or approximately 980 centimeters per second.

Areas that are underlain by bedrock tend to experience less ground shaking than those underlain by unconsolidated sediments such as artificial fill. The composition of underlying materials in areas located relatively distant from faults can intensify ground shaking. Portions of the Bay Area that experienced the worst structural damage due to the Loma Prieta earthquake were not those closest to the fault, but rather those with soils that amplified the effects of ground shaking. The Modified Mercalli (MM) intensity scale (see Table 2.4-2) is a common measure of earthquake effects due to ground shaking intensity. The MM values for intensity range from I (earthquake not felt) to XII (damage nearly total), and intensities ranging from IV to X could cause moderate to significant structural damage.[12]

Areas most susceptible to intense ground shaking are those areas located closest to the earthquake-generating fault, and areas underlain by thick, loosely unconsolidated, saturated sediments, particularly soft, saturated Bay Muds and artificial fill along the tidal margins of San Francisco Bay.

Liquefaction

Liquefaction is a phenomenon whereby unconsolidated and/or near saturated soils lose cohesion and are converted to a fluid state as a result of severe vibratory motion. The relatively rapid loss of soil shear strength during strong earthquake shaking results in the temporary fluid-like behavior of the soil. Soil liquefaction causes ground failure that can damage roads, airport runways, pipelines, underground cables, and buildings with shallow foundations. Liquefaction can occur in areas characterized by water-saturated, cohesionless, granular materials at depths less than 40 feet.[13] In addition, liquefaction can occur in areas with unconsolidated or artificial fill sediments, such as those located in reclaimed areas along the margin of San Francisco Bay. The depth of groundwater also influences the potential for liquefaction in these areas: the shallower the groundwater, the higher potential for liquefaction. Liquefaction potential is highest in areas underlain by Bay fills, Bay Mud, and unconsolidated alluvium. Figure 2.4-2 illustrates liquefaction susceptibility in the San Francisco Bay Area.

Landslide Hazards

A landslide is a mass of rock, soil, and debris displaced downslope by sliding, flowing, or falling. The susceptibility of land (slope) failure is dependent on slope and geologic characteristics, as well as the amount of rainfall and the nature of excavation or seismic activities. Areas with steep slopes and downslope creep of surface materials are most susceptible to landsliding.

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[12] The damage level represents the estimated overall level of damage that will occur for various MM intensity levels. The damage, however, will not be uniform. Some structures will experience substantially more damage than this overall level, and others will experience substantially less damage. Not all structures perform identically in an earthquake. The age, material, type, method of construction, size, and shape of a structure all affect its performance (Association of Bay Area Governments (ABAG), *The San Francisco Bay Area -- On Shaky Ground*, Supplement Report (Excerpts), http://www.abag.ca.gov/bayarea/eqmaps/mapsba.html, 1998.).

[13] Association of Bay Area Governments (ABAG), Excerpts from CDMG DRAFT Study Guidelines http://www.abag.ca.gov/Bayarea/eqmaps/liquefac/lqguide.html, 1996, (recently replaced by http://www.abag.ca.gov/bayarea/eqmaps/liquefac/liquefac.html.).

Landslides are least likely in areas of low relief, such as topographically low alluvial fans and at the margin of San Francisco Bay. Figure 2.4-3 illustrates areas that have historically been affected by landslide activity.

Expansive Soils

Expansive soils possess a “shrink-swell” characteristic. Shrink-swell is the cyclic change in volume (expansion and contraction) that occurs in fine-grained clay sediments from the process of wetting and drying. Structural damage may occur incrementally over a long period of time, usually as a result of inadequate soil and foundation engineering or the placement of structures directly on expansive soils. Soils with high clay content, such as the Bay Muds located on the southern margin of San Francisco Bay, are highly expansive.

Soil Erosion

Soil erosion is the process whereby soil materials are worn away and transported to another area, either by wind or water. Rates of erosion can vary depending on soil material and structure, building placement, and human activity. The potential for soil erosion is variable throughout the project area. Soil with high amounts of silt can be easily eroded, while sandy soils are less susceptible to erosion. Excessive soil erosion can eventually damage building foundations, roadways, and dam embankments. Erosion is most likely on sloped areas with exposed soil, especially where unnatural slopes are created by cut-and-fill activities. Soil erosion rates can therefore be higher during the construction phase. Typically, the soil erosion potential is reduced once the soil is graded and covered with concrete, structures, or asphalt.

Settlement

Settlement is the depression of the bearing soil when a load, such as that of a building or new fill material, is placed upon it. Soils tend to settle at different rates and by varying amounts, depending on the load weight, which is a phenomenon referred to as differential settlement. Areas are susceptible to differential settlement if underlain by compressible sediments, such as poorly engineered artificial fill or the “Bay Mud” present in the marshland on the San Francisco Bay margin.

Earthquake-Induced Settlement

Settlement of the ground surface can be accelerated and accentuated by earthquakes. During an earthquake, settlement can occur as a result of the relatively rapid compaction and settling of subsurface materials (particularly loose, noncompacted, and variable sandy sediments) due to the rearrangement of soil particles during prolonged ground shaking. Settlement can occur both uniformly and differentially (i.e., where adjoining areas settle at different rates). Areas are susceptible to differential settlement if underlain by compressible sediments, such as poorly engineered artificial fill or Bay Mud.

Figure 2.4-2
Areas Susceptable to Liquefaction in the San Francisco Bay Area

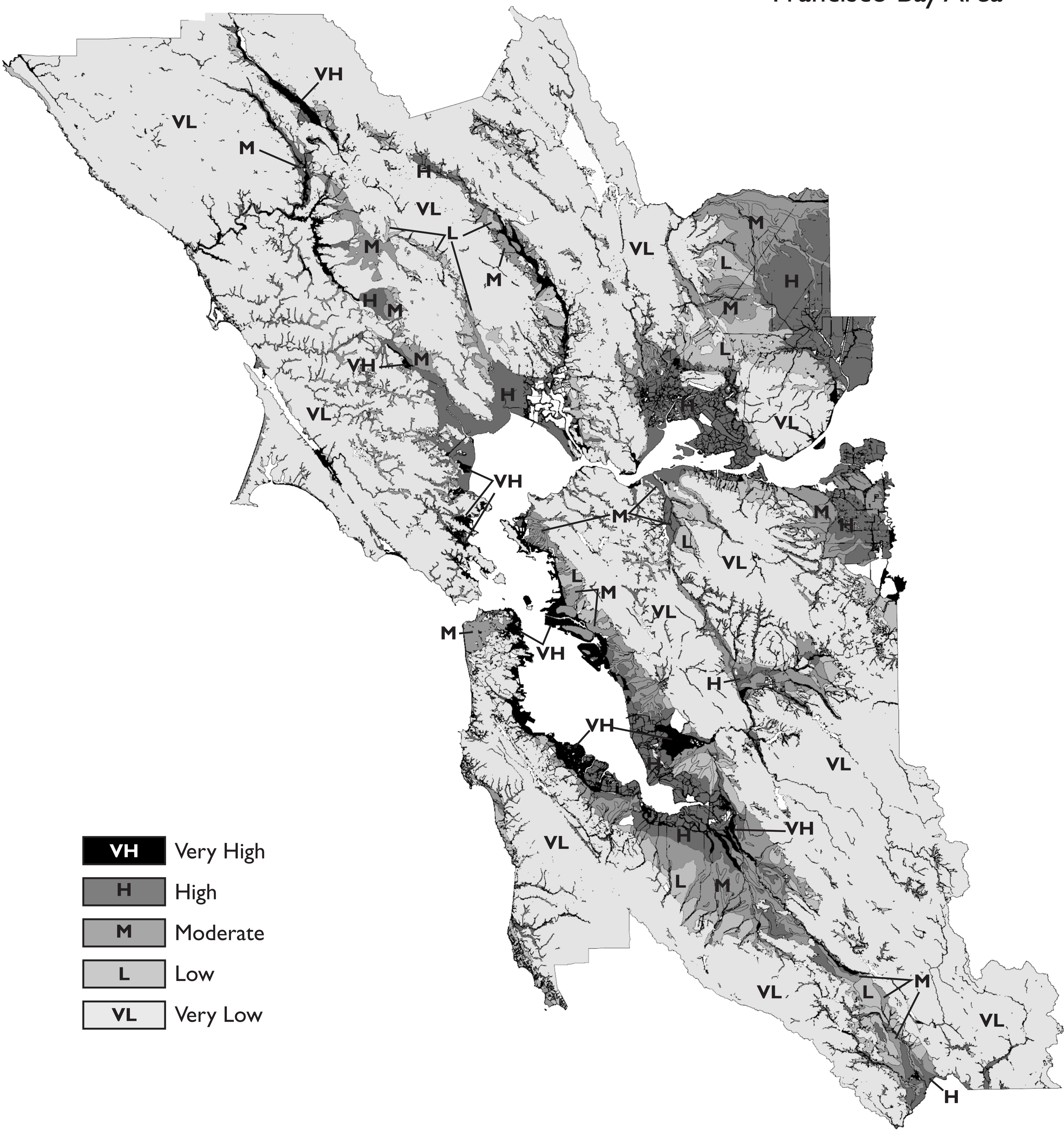
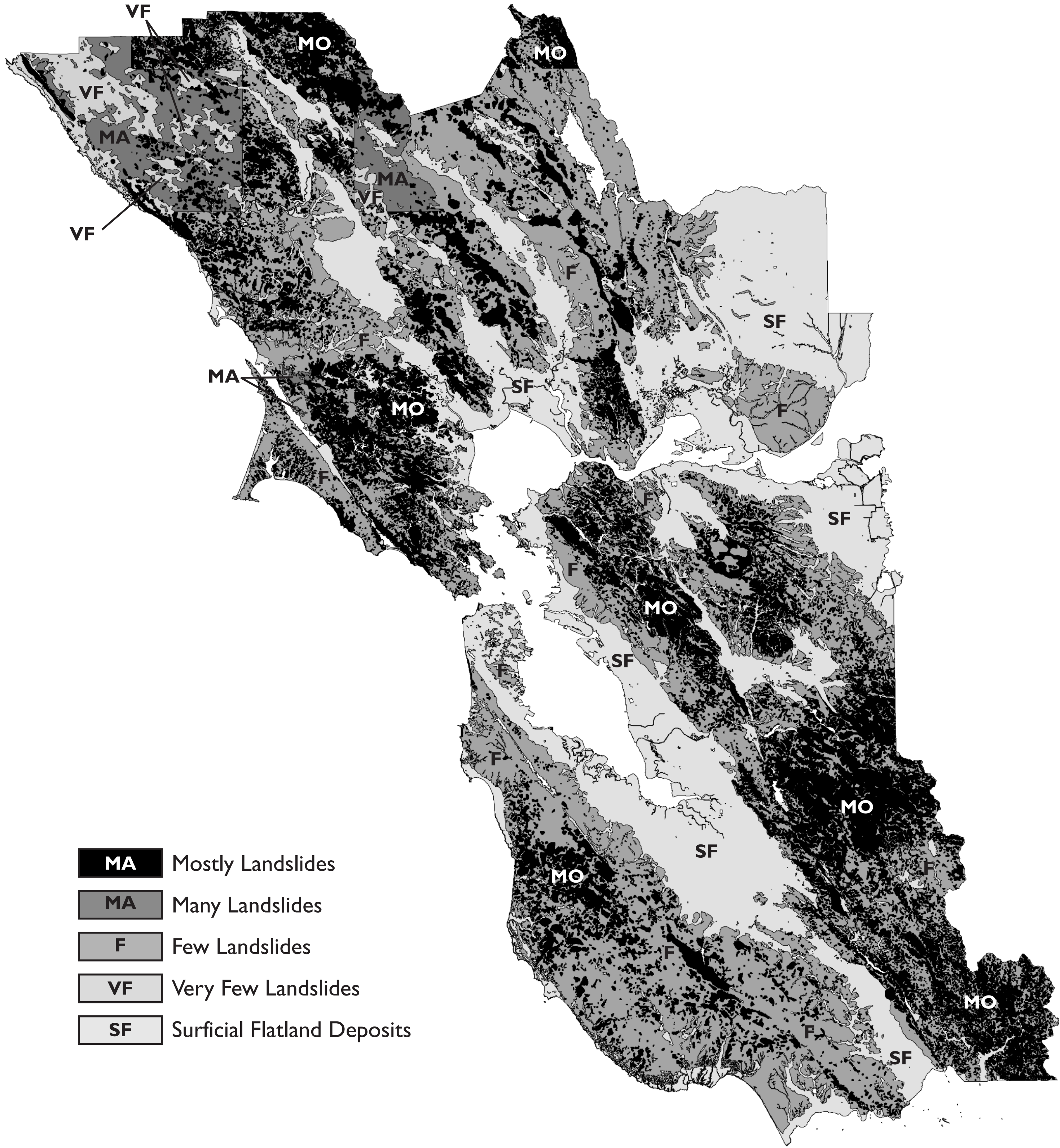


Figure 2.4-3

Areas Susceptable to Landslides in the San Francisco Bay Area



Tsunami

Tsunamis (seismic sea waves) are long period waves that are caused by underwater seismic disturbances, volcanic eruptions, or submerged landslides. Tsunamis affecting the Bay Area would most likely originate west of the Bay, within the Pacific Rim. During the period between 1854 and 1964, approximately 21 tsunamis were recorded at the Fort Point tide gauge in San Francisco. The largest wave height recorded was 7.4 feet resulting from the 1964 Alaska earthquake. It is estimated that a tsunami with a wave height or run up to 20 feet could pass through the Golden Gate every 200 years. A ten-foot wave is estimated to occur every 90 years. A tsunami of this height would most likely produce little inundation damage except for beaches and other low-lying coastal areas.

Areas that are highly susceptible to tsunami inundation tend to be located in low-lying coastal areas such as tidal flats, marshlands, and former bay margins that have been artificially filled. Highway traffic in those low-lying areas may be disrupted due to inundation or damage caused by the tsunami.

POLICY AND REGULATION

FEDERAL REGULATIONS

U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS)

The NRCS maps soils and farmland uses to provide the information necessary for understanding, managing, conserving, and sustaining the nation's limited soil resources. In addition to many other natural resource conservation programs, the NRCS manages the Farmland Protection Program, which provides funds to help purchase development rights to keep productive farmland in agricultural uses. Working through existing programs, USDA joins with state, tribal, or local governments to acquire conservation easements or other interests from landowners.

STATE REGULATIONS

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act (formerly the Alquist-Priolo Special Studies Zone Act), signed into law in December 1972, requires the delineation of zones along active faults in California. The purpose of the Alquist-Priolo Act is to regulate development on or near fault traces to reduce the hazard of fault rupture and to prohibit the location of most structures for human occupancy across these traces. Cities and counties must regulate certain development projects within the zones, for example, by withholding permits until geologic investigations demonstrate that development sites are not threatened by future surface displacement.[14] Surface fault rupture is not necessarily restricted to the area within an Alquist-Priolo Zone.

[14] Hart, 1997.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act of 1990 was established to protect the public from the effects of strong ground shaking, liquefaction, landslides, or other ground failure, and from other hazards caused by earthquakes. This act requires the State Geologist to delineate various seismic hazard zones and requires cities, counties, and other local permitting agencies to regulate certain development projects within these zones. Before a development permit is granted for a site within a seismic hazard zone, a geotechnical investigation of the site must be conducted and appropriate mitigation measures incorporated into the project design. Although Seismic Hazards Maps have been released for San Francisco County and portions of the East Bay and San Jose, the California Division of Mines and Geology has not yet completed Seismic Hazards Maps covering the entire Bay Area.

California Department of Transportation

Jurisdiction of the California Department of Transportation (Caltrans) includes state and interstate routes within California. Any work within the right-of-way of a federal or state transportation corridor is subject to Caltrans regulations governing allowable actions and modifications to the right-of-way. Caltrans issues permits to allow encroachment on land within its jurisdiction to ensure that the encroachment is compatible with the primary uses of the State Highway System, ensure safety, and to protect the state's investment in the highway facility. The encroachment permit requirement applies to persons, corporations, cities, counties, utilities, and other government agencies. A permit is required for specific activities, including opening or excavating a state highway for any purpose, constructing and maintaining road approaches or connections, grading within right-of-way on any state highway, or planting or tampering with vegetation growing along any state highway. The encroachment permit application requirements relating to geology, seismicity, and soils include information on road cuts, size of excavations, engineering and grading cross-sections, hydraulic calculations, and the location of mineral resources approved under the Surface Mining Area Reclamation Act.

COUNTY AND CITY CONTROLS

General Plans and Seismic Safety Element

City and county governments typically develop, as part of a general plan, safety and seismic elements that identify goals, objectives, and implementing actions to minimize the loss of life, property damage, and disruption of goods and services from man-made and natural disasters, including floods, fires, nonseismic geologic hazards, and earthquakes. General plans can provide policies and develop ordinances to ensure acceptable protection of people and structures from risks associated with these hazards. Ordinances can include those addressing unreinforced masonry construction, erosion, or grading.

CRITERIA OF SIGNIFICANCE

This EIR uses the following geology and seismicity criteria to assess whether proposed improvements in the 2001 RTP would have a significant adverse effect:

- **Criterion 1: Expose people or structures to potential damaging geologic forces.** Implementation of the 2001 RTP would have a potentially significant impact if increases the exposure of people to the risk of property loss, injury, or death involving:
  - Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault
  - Strong seismic ground shaking
  - Seismic-related ground failure, including liquefaction
  - Landslides
- **Criterion 2: Substantial soil erosion or topsoil loss.** Implementation of the 2001 RTP would have a potentially significant impact if associated projects result in substantial soil erosion or topsoil loss; and
- **Criterion 3: Located on expansive soils.** Implementation of the 2001 RTP would have a potentially significant impact if associated projects are located on expansive soil (high shrink-swell potential), as defined in Table 18-1-B of the Uniform Building Code, or on weak, unconsolidated soils creating substantial risks to life or property.

METHOD OF ANALYSIS

Impacts are determined for the 2001 RTP as a whole and for specific projects involving new construction. Transportation project locations have been compared to general geology maps from the 1998 RTP EIR. These maps provide broad information on areas of estimated ground shaking response, liquefaction potential, and fault location. Due to the scale of these maps, this analysis should be used in the most general sense; this analysis does not satisfy the need for site-specific surveys for individual projects.

SUMMARY OF IMPACTS

The entire Bay Area is susceptible to impacts associated with seismic events on one of the several active or potentially active faults in the region. These faults could potentially generate seismic ground shaking capable of damaging existing and proposed transportation facilities. As such, new transportation facilities would be exposed to both the direct and indirect effects of earthquakes. Potential effects from surface fault rupture and severe ground shaking could cause catastrophic damage to transportation infrastructure, particularly elevated structures. Seismic exposure during construction would be considered short-term, while long-term impacts would be expected to continue throughout the life of the project or facility. The impact analysis in this section addresses both short-term and long-term geologic hazards.

The 2001 RTP includes the vast majority of the seismic retrofit and strengthening work for Bay Area transportation facilities, particularly the Bay Bridge. New transportation facility designs would make use of the latest information available on seismic hazards to structures.

DIRECT IMPACTS

Direct impacts associated with earthquakes include construction of new transportation facilities which would be exposed to fault rupture, ground shaking, liquefaction and potential tsunamis, and earthquake-induced landslides. Over time, unconsolidated soils can also pose problems to transportation facilities.

Short Term Impacts

Short-term impacts are those that could potentially occur during construction of transportation improvements. Soil erosion hazards could occur during preliminary stages of construction, especially during initial site grading. In addition to causing sedimentation problems in storm drain systems, rapid water erosion could remove topsoil, cause deeply incised gullies on slopes, or undermine engineered soils beneath foundations and paved surfaces.

Long Term Impacts

Road cuts could also expose soils to erosion over the life of the project, creating potential landslide and falling rock hazards. Engineered roadways can be undercut over time by uncontrolled stormwater drainage. Projects on steep grades or those requiring substantial amounts of cut and fill would pose the greatest potential for slides and erosion impacts. Engineered soils could also erode due to poor construction methods and design features or lack of maintenance. Use of appropriate construction methods, earthwork design, and road cut design could reduce this potential impact to a less-than-significant level.

Surface Fault Rupture

Some of the proposed transportation improvement projects would be located within Alquist-Priolo Earthquake Hazard Zones and would therefore be susceptible to fault rupture if an earthquake were to occur on the particular fault segment. The occurrence and severity of fault rupture depends on, among other factors, the location of the fault trace, magnitude of the seismic event, and underlying geology. Damage caused by surface fault rupture could include displaced pavement, rupture to underground utilities, or damage to foundations.

Table 2.4-3 provides examples of projects susceptible to surface fault rupture hazards. The areas susceptible to severe fault rupture are generally those very close to one of the 11 major active earthquake-generating faults. Potential for structural damage injury or of life is related to the severity of the earthquake or type of construction (aerial, at-grade, tunnels, etc.). Modern design techniques focus on the preservation of life and lessening the risk of injury. These are projects with the potential to be adversely affected by lateral or vertical displacement during an earthquake of considerable magnitude.

Table 2.4-3: 2001 RTP Projects Likely to Experience Fault Rupture

Corridor/Subarea	*Project*
North Bay East-West	Widen Rte. 12 from 2 to 4 lanes between Solano County line and Rte. 29
	New Rte. 29/221 flyover
	Rte. 12/29 grade separation and Rte. 12/29/121 intersection improvements
Eastshore-North	Hayward Bypass (Rte. 238) Harder Ave. to Industrial Pkwy.
Delta	Vasco Rd. safety improvements
	Widen Rte. 4 from 4 to 8 lanes between Loveridge Rd. and Somersville Rd.
	Widen Rte. 4 from 4 to 6 lanes between Somersville Rd. and Route 160
Diablo	Auxiliary lane from Bollinger Canyon Rd. to Diablo Rd.
	I-80/I-680/Rte. 12 interchange improvements
	I-680 southbound HOV lanes between Marina Vista and N. Main St. and northbound between Rte. 242 and Marina Vista
Tri-Valley	I-580/Isabel Avenue (Rte. 84) interchange improvements
	Eastbound and westbound HOV lanes between Tassajara Rd. and Vasco Rd.
Fremont–South Bay	BART to Warm Springs
	Silicon Valley Rapid Transit Corridor Project (Project A)
	Rail grade separations at Washington Blvd. and Paseo Padre Pkwy.

Source: Environmental Science Associates, 2001

Ground Shaking

Proposed transportation improvements susceptible to intense seismic ground shaking are also those areas in close proximity to the causative faults, and those areas underlain by thick, unconsolidated deposits, particularly soft, saturated Bay Mud and artificial fill near the shoreline of the Bay. These soft, loosely consolidated, saturated sediments have the tendency to amplify ground shaking and cause structural damage or result in collapse of older structures, especially those that have not undergone seismic retrofitting. Table 2.4-4 summarizes proposed projects located in areas most likely to experience very strong (Modified Mercalli intensity VIII or greater) ground shaking. Ground shaking probabilities were determined using published and unpublished USGS information provided by the Association of Bay Area Governments (ABAG).

Table 2.4-4: 2001 RTP Projects Likely to Experience Intense Ground Shaking

Corridor	*Project*	*Probability of Ground Shaking Intensity VIII–X*
Golden Gate	Northbound and southbound HOV lanes between Sonoma County line and Old Redwood Highway	>45%
	Widen US 101 from 4 to 6 lanes between Rte. 37 and Sonoma County line	>45%
	US 101/Tamalpais interchange improvements	>45%

Table 2.4-4: 2001 RTP Projects Likely to Experience Intense Ground Shaking

Corridor	*Project*	*Probability of Ground Shaking Intensity VIII–X*
	Manzanita park and ride lot	>50%
North Bay East-West	Widen Rte. 12 from 2 to 4 lanes between Solano County line and Rte. 29	>45%
	Rte. 12/29 grade separation and Rte. 12/29/121 intersection improvements	>45%
Eastshore-North	Ashby Ave. interchange improvements	>60%
	Gilman Ave. interchange improvements	>60%
	Hercules transit center	>55%
	Vallejo intermodal ferry station	>50%
	Vallejo ferry maintenance facility	>50%
	Various interchange and arterial improvements	>50%
Diablo	Auxiliary lane from Bollinger Canyon Rd. to Diablo Rd.	>50%
	Martinez intermodal terminal facility	>55%
Tri-Valley	Widen Dublin Boulevard from Village Pkwy. to Sierra Ct.	>40%
Eastshore-South	Tinker Avenue extension from Main St. to Webster St.	>60%
	Realign Langley St. and reconstruct Rte. 61 (Doolittle Dr.)	>60%
	BART-Oakland International Airport connector	>60%
	Port of Oakland Joint Intermodal Terminal	>60%
	Various I-880 interchange improvements	>60%
Peninsula	Various Caltrain system improvements	>50%
	Various US 101 interchange improvements	>50%

Source: Environmental Science Associates, 2001

Liquefaction and Earthquake-Induced Landslides

The California Department of Mines and Geology, pursuant to the Seismic Hazards Act of 1990, has begun preparing seismic hazard maps of the San Francisco Bay Area. These maps identify areas highly susceptible to liquefaction or earthquake-induced landslides. At this time, only a portion of the Bay Area has been mapped. Therefore, specific information on areas prone to liquefaction or seismically induced landslides is not available for each of the proposed transportation improvements in the 2001 RTP.

The potential for transportation projects to be significantly affected by earthquake-induced landslides is higher in hilly or mountainous areas, especially areas with historically active or inactive landslides and unstable slopes. Landslide hazards are prevalent in the Santa Cruz Mountains, the Diablo Range, and areas of Marin County. Certain geologic formations, such as moderately consolidated sedimentary deposits, are more susceptible to landslides in the event of an earthquake. Saturated slopes in close proximity to the causative fault can also increase the likelihood of landslide hazards. Historically active landslide areas are depicted in Figure 2.4-2.

The potential for projects to be significantly affected by liquefaction would be higher in areas exhibiting shallow groundwater and unconsolidated, coarse-grained soils, such as sandy artificial fill materials or dredge spoils overlying Bay Mud. Figure 2.4-3 illustrates liquefaction susceptibility throughout the Bay Area. Projects located in areas most likely to be susceptible to liquefaction are listed in Table 2.4-5. Table 2.4-5 is based on information available from published and unpublished USGS sources obtained through ABAG.

Inadequate soil and foundation engineering on weak or unconsolidated soils (such as poorly engineered artificial fill) could cause soils and overlying structures to settle unevenly, thereby weakening structural facilities. Low-strength soils subjected to settlement could, over time, cause damage to underground utilities such as pipelines and tunnels. Structures placed directly on expansive soils could be subject to seasonal shrink/swell effects, causing structural damage and possibly damage to underground utilities.

Table 2.4-5: 2001 RTP Projects Subject to Liquefaction

Corridor	*Project*
Eastshore-North	Ashby Ave. interchange improvements
	Gilman Ave. interchange improvements
	Hercules transit center
	Vallejo ferry maintenance facility
Tri-Valley	Isabel Ave. (Rte. 84)/I-580 interchange
Diablo	Commerce Avenue extension between Pine Creek Rd. and Waterworld Pkwy.
	Martinez intermodal terminal facility
Eastshore-South	Tinker Avenue extension from Main St. to Webster St.
	Rte. 262 interchange improvements
	Realign Langley St. and reconstruct Rte. 61 (Doolittle Dr.)
	Widen Union City Blvd. from 4 to 6 lanes between Paseo Padre and Industrial Pkwy.
	BART-Oakland International Airport connector
	Port of Oakland Joint Intermodal Terminal
	Widen Rte. 262/Warren Ave./I-880 interchange and East Warren Ave./UPRR grade separation
	I-880/Broadway-Jackson interchange improvements
Fremont–South Bay	Rte. 84 southbound HOV between Newark Blvd. and I-880
	BART to Warm Springs
	Silicon Valley Rapid Transit Corridor Project (Project A)

Table 2.4-5: 2001 RTP Projects Subject to Liquefaction

Corridor	*Project*
	Rte. 84 southbound HOV onramp from Newark Blvd. to existing southbound HOV lane
	Westbound auxiliary lanes on Rte. 237 between Coyote Creek Bridge and North First St.
Golden Gate	US 101/Tamalpais interchange improvements
	Manzanita park and ride lot
Peninsula	US 101 northbound and southbound auxiliary lanes between Third Ave. and Millbrae/Peninsula Interchange.
	US 101/Broadway Ave. interchange reconstruction
	US 101 northbound and southbound auxiliary lanes between Sierra Pt. Pkwy. and San Francisco County line
	US 101 northbound and southbound auxiliary lanes between San Bruno Ave. and Grand Ave.
	Various Caltrain system improvements
Silicon Valley	Widen Montague Expwy. from 6 to 8 lanes between US 101 and Mission College Blvd.
	New Montague Expwy./Trimble Rd. flyover
	SR 87/US 101 ramp to Trimble Rd. interchange
	Rte. 85 northbound and southbound auxiliary lanes between I-280 and Fremont Ave.
	US 101 northbound and southbound auxiliary lanes between Rte. 87 to Montague Expwy.
San Francisco	Third Street Light Rail Transit extension to Chinatown (Central Subway) (Project A)

Source: Environmental Science Associates, 2001

Tsunamis

Tsunamis could occur along the Pacific Ocean shoreline and along the Bay shoreline resulting in temporarily high water levels and possible property damage, erosion, injury and loss of life and structural damage.

INDIRECT/CUMULATIVE IMPACTS

The projected population increase in the Bay Area will result in increased travel on all modes of transportation. This would result in an increased risk of exposure of people and property to the potentially damaging effects of strong seismic shaking, fault rupture, seismically-induced ground failure and slope instability. The potential for structural failures, injuries and loss of life would be greatest on raised structures, on earthquake susceptible soils and within fault zones. The cumulative impacts from the 2001 RTP are essentially the same as the direct impacts outlined above.

BENEFICIAL IMPACTS

The 2001 RTP includes seismic strengthening of a number of existing bridges, interchanges, and overpasses throughout the Bay Area. In addition, all new transportation facilities, including potentially vulnerable elevated structures such as BART tracks, interchanges, and bridge, will be designed to current seismic standards that were updated as a result of information acquired from the Loma Prieta and Northridge earthquakes. It is expected that as a result of these efforts, implementation of the 2001 RTP will improve the survivability of the Bay Area transportation system, reduce the risk to travelers using existing retrofitted and new transportation facilities, and reduce the overall magnitude and extent of social and economic disruption in the event of a major seismic event.

SIGNIFICANT IMPACTS AND MITIGATION MEASURES

IMPACT

2.4-1 **Seismic events could damage existing and proposed transportation infrastructure through surface rupture, ground shaking, liquefaction, landslides and tsunamis. Potential impacts to property and public safety from seismic activity would be considered significant.**

MITIGATION MEASURES

MTC requires project sponsors to comply with CEQA and NEPA prior to project approval by MTC. The following mitigation measures shall be included in project-level analysis as appropriate for proposed new transportation improvements. The project proponent or local jurisdiction shall be responsible for ensuring adherence to the mitigation measures outlined below prior to construction.

- The seismic design of projects shall consider seismicity of the site, soil response at the site, and dynamic characteristics of the structure, in compliance with the Uniform Building Code and Caltrans standards for construction, or other more stringent standards, as applicable.
- Implementing agencies shall ensure that geotechnical analyses are conducted within construction areas to ascertain soil types and local faulting prior to preparation of project designs.
- Implementing agencies shall ensure that projects avoid or stabilize landslide areas and potentially unstable slopes wherever feasible.
- For projects located within liquefaction or earthquake-induced landslide Seismic Hazard Zones, or Earthquake Hazard Zones, recommendations for the mitigation and reduction

of hazards shall be prepared in accordance with California Division of Mines and Geology Guidelines for Evaluating and Mitigating Seismic Hazards.[15]

- Consider tsunami inundation risks when designing projects adjacent to the Bay, and/or Pacific Ocean. Precautionary measures such as specifying final roadbed elevations greater than the expected height of a tsunami with a given return frequency would be effective.

SIGNIFICANCE AFTER MITIGATION

Implementation of the above mitigation measures would reduce seismic hazards from new transportation facilities. Although most new structures would be constructed to survive a strong earthquake without collapse, it is likely that some segments of roads and transit facilities would be damaged. The damage from a major seismic event could be significant.

IMPACT

2.4-2 Highway and rail construction could require significant earthwork and road cuts. Such projects could increase short-term and long-term soil erosion potential and slope failure.

MITIGATION MEASURES

- Implementing agencies shall ensure that projects employ Best Management Practices to reduce soil erosion by water and wind. These could include temporary cover of exposed, engineered slopes, or silt fencing. All construction activities and design criteria shall comply with applicable codes and requirements of the 1997 Uniform Building Code with California additions (Title 22), and applicable Caltrans construction and grading ordinances.
- Implementing agencies shall ensure that project designs provide adequate slope drainage and appropriate landscaping to minimize the occurrence of slope instability and erosion. Design features shall include measures to reduce erosion from stormwater. Road cuts shall be designed to maximize the potential for revegetation.

SIGNIFICANCE AFTER MITIGATION

These mitigation measures would be expected to reduce this potentially significant risk of soil erosion and/or slope failure to a less-than-significant level if incorporated by project sponsors.

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[15] CDMG, 1997.

IMPACT

2.4-3 Projects built on highly compressible or expansive soils could become damaged and weakened over time.

MITIGATION MEASURES

Implementing agencies shall ensure that geotechnical investigations be conducted by qualified professionals (registered civil and geotechnical engineers, registered engineering geologists) to identify the potential for differential settlement and expansive soils. Recommended corrective measures, such as structural reinforcement and replacing soil with engineered fill, shall be incorporated into project designs.

SIGNIFICANCE AFTER MITIGATION

These mitigation measures would be expected to reduce the risk of exposure to highly compressible or expansive soils to a less-than-significant level if incorporated by project sponsors.

CUMULATIVE IMPACT

2.4-4 The projected population increase in the Bay Area will result in increased travel on all modes of transportation. This would result in an increased risk of exposure of people and property to the potentially damaging effects of strong seismic shaking, fault rupture, seismically-induced ground failure and slope instability.

MITIGATION MEASURES

Since the cumulative impacts from the 2001 RTP are essentially the same as the direct and short-term impacts (exposing travelers to geologic hazards), the mitigation measures for this impact would be the same as for those outlined above.

SIGNIFICANCE AFTER MITIGATION

These mitigation measures would be expected to reduce this potentially significant cumulative impact to a less-than significant level.

2.5 Biological Resources

This chapter outlines the biological resources (terrestrial plants and wildlife) of the Bay Area and represents an update of biological data presented in the 1998 RTP EIR by drawing on the California Department of Fish and Game Natural Diversity Data Base (CNDDB)[1], recent local general and area plans and environmental impact reports, and environmental impact reports on specific transportation projects. Various habitat types found in the region and associated rare, threatened and endangered (special-status) species, and areas of ecological significance are characterized. The potential effects of the 2001 RTP on sensitive species and the fragmentation of existing habitats are identified. The information and analysis presented are regional in scope. The assessment is intended to assist area-wide issue identification as it relates to regional transportation planning. Site-specific environmental assessment will be necessary to determine the impacts of specific transportation projects on biological resources.

SETTING

ECOSYSTEMS IN THE BAY AREA

The Bay Area supports an extensive diversity of distinct vegetative communities.[2] Broad habitat categories generally include coastal scrubs, oak woodlands, grasslands, estuaries, coastal salt marsh, riparian habitats, and eucalyptus groves, interior wetlands, and rivers and streams. Interior wetlands, estuaries, rivers and streams, and urban/highly disturbed habitats are not vegetative communities per se, but provide wildlife habitat. Due to the amount of native vegetation lost to urbanization throughout California, several specific native vegetative communities have been identified as rare and/or sensitive by the California Department of Fish and Game (CDFG). These natural communities are of special significance because the present rate of loss indicates that additional acreage reductions or further habitat degradation may threaten the viability of dependent plant and wildlife species and possibly hinder the long-term sustainability of the community or species dependent upon the community.

Some of these natural communities have a rich complement of sensitive species and species-oriented programs that will usually protect them. Other communities do not support rare species and, therefore, species-oriented protection cannot be invoked. Sensitive communities in the Bay

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[1] The CNDDB is a computer data base of the location and distribution of animals and plants that are rare, threatened, endangered or candidate species, or habitat considered to be of high quality or of limited distribution.

[2] Natural communities are compositions of species that reoccur due to responses to similar combinations of environmental conditions and are not dependent on human intervention. For this discussion, native vegetation pertains to those species present in California prior to European colonization, while species such as wild oats and brome grasses, which dominate much of the current California landscape, are considered non-native. Vegetative communities that are dependent on human intervention, such as horticultural species, irrigated agriculture, or landscaping, are considered introduced communities.

Area include coastal salt marsh, freshwater wetlands, and mixed oak woodlands (coast live oak occurs as an upland and riparian community within the Bay Area).[3]

Following are descriptions of the following Bay Area ecosystems:

- Coastal shrub and chaparral;
- Grasslands;
- Riparian; and
- Rivers and streams.

Descriptions of Bay Area coastal marsh and estuaries, woodlands, eucalyptus grove and interior wetland ecosystems are included in Appendix D of this EIR.

Coastal Scrub and Chaparral

The coastal scrub and sage scrub plant communities in the Bay Area are recognized on the basis of the dominant species: California buckwheat, black sage, California sagebrush, California buckwheat, coyote brush, mixed sage, and purple sage series.[4] They are particularly dominant in the more dry, southern slopes and on exposed rocky slopes and bluffs within the Coast Ranges in the Bay Area. The coastal scrub is best considered as a collection or assemblage of different vegetation series, with various intergrades between the above-described plant communities. The coastal sage scrubs mix with various coastal terrace forests, grasslands, chaparrals, and foothill woodlands and are common in Marin, San Francisco, San Mateo Counties near the 2001 RTP corridors. A similar chaparral habitat occurs in the Diablo Range in Contra Costa and Alameda Counties, but maintains many of the same basic vegetative elements. Vegetation mosaics can be controlled by the soil type, slope exposure, and summer fog. Generally, these are communities of dense, low shrubs with scattered grassy openings. Most growth and flowering occur in late spring and early summer.

The distribution of rare plants and wildlife often coincides with the distribution of uncommon geological features. In the case of coastal scrub plant communities, an array of plants and wildlife have adapted to serpentine-derived soils in both scrub habitats and grasslands. Such habitats may occur as individual rock outcrops on hillsides or steeper talus slopes, or as moderately sloped hillsides and alluvial deposits. Special-status serpentine-adapted scrub species include: coyote ceanothus (*Ceanothus ferrisae*), Presidio clarkia (*Clarkia franciscana*), Mt. Diablo bird's beak

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[3] The CDFG and California Native Plant Society recognize uncommon, vulnerable, or regionally declining habitat types as sensitive or significant communities. These communities are tracked by the CDFG in the California Natural Diversity Data Base. Each community appearing in the database is assigned a rarity and threat ranking that indicates current known acreage of the community, known threats, and the community's sensitivity to perturbation.

[4] Sawyer, J.O. and T. Keeler-Wolf. *A Manual of California Vegetation*. California Native Plant Society. Sacramento, California. 1995.

(*Cordylanthus nidularius*), Marin checker lily (*Fritillaria affinis* var. *tristulis*), fragrant fritillary (*Fritillaria liliacea*), Crystal Springs lessingia (*Lessingia arachnoidea*), smooth lessingia (*Lessingia micradenia* var. *glabrata*), Marin checkerbloom (*Sidalcea hickmanii* var. *viridis*), San Francisco campion (*Silene verecunda* var. *verecunda*), and Tamalpais jewel-flower (*Streptanthus batrachopus*). Those plants not specifically adapted to serpentine habitats include: San Francisco Bay spineflower (*Chorizanthe cuspidata* var. *cuspidata*), woolly-headed spineflower (*Chorizanthe cuspidata* var. *villosa*), yellow larkspur (*Delphinium luteum*), supple daisy (*Erigeron supplex*), Mt. Diablo buckwheat (*Eriogonum truncatum*), coast wallflower (*Erysisum ammophilum*), robust monardella (*Monardella villosa* var. *globosa*), Marin County navarretia (*Navarretia rosulata*), north coast phacelia (*Phacelia insularis* var. *continentis*), and Metcalf Canyon jewel flower (*Streptanthus albidus* ssp. *albidus*). Generalized habitat for special-status plant and wildlife species listed in this section, and their listing status is provided in Table B-1, included in this EIR as Appendix D.

There are relatively fewer rare wildlife species within coastal scrub habitats, and these are typically highly specialized invertebrates whose life histories are intimately dependent upon serpentine-associated species. These include callippe silverspot butterfly (*Speyeria callippe callippe*) and two non-serpentine-dependent species, San Bruno elfin butterfly (*Incisalia mossii bayensis*), and mission blue butterfly (*Icaricia icarioides missionensis*). In Contra Costa and Alameda Counties, chaparral and scrub habitats and adjacent grasslands support the federally threatened Alameda whipsnake (*Masticophis lateralis euryxanthus)*. Designated critical habitat for the Alameda whipsnake includes portions of Contra Costa, Alameda, and Santa Clara Counties, where whipsnake distribution coincides closely with chaparral habitat and adjacent grasslands and oak-dominated habitats.[5] Figure 2.5-1 shows the distribution of critical habitat for the Alameda whipsnake in the Bay Area, which is concentrated in the East Bay Hills.

In addition, as a result of the vegetative mosaics in scrub habitats, several of the rare plants described above are frequently found in grasslands, coastal prairies, and other adjacent habitats, particularly those species with high affinity to serpentine-derived soils. Conditions such as slope, aspect, precipitation, temperature, degree of exposure, and the presence of suitable soil conditions often mandate the distribution of rare species.

Grasslands

Grasslands within the Bay Area include three community types[6]: the non-native grasslands, and the less common serpentine bunchgrass and valley needlegrass grasslands. Non-native annual grasslands occur throughout the Bay Area and consist of a dense to sparse cover of annual grasses associated with a variety of broadleaf herbs and perennial grasses. The most abundant species are generally non-native annual grasses in the genera *Bromus, Avena, Lolium*, and *Vulpia*. Common

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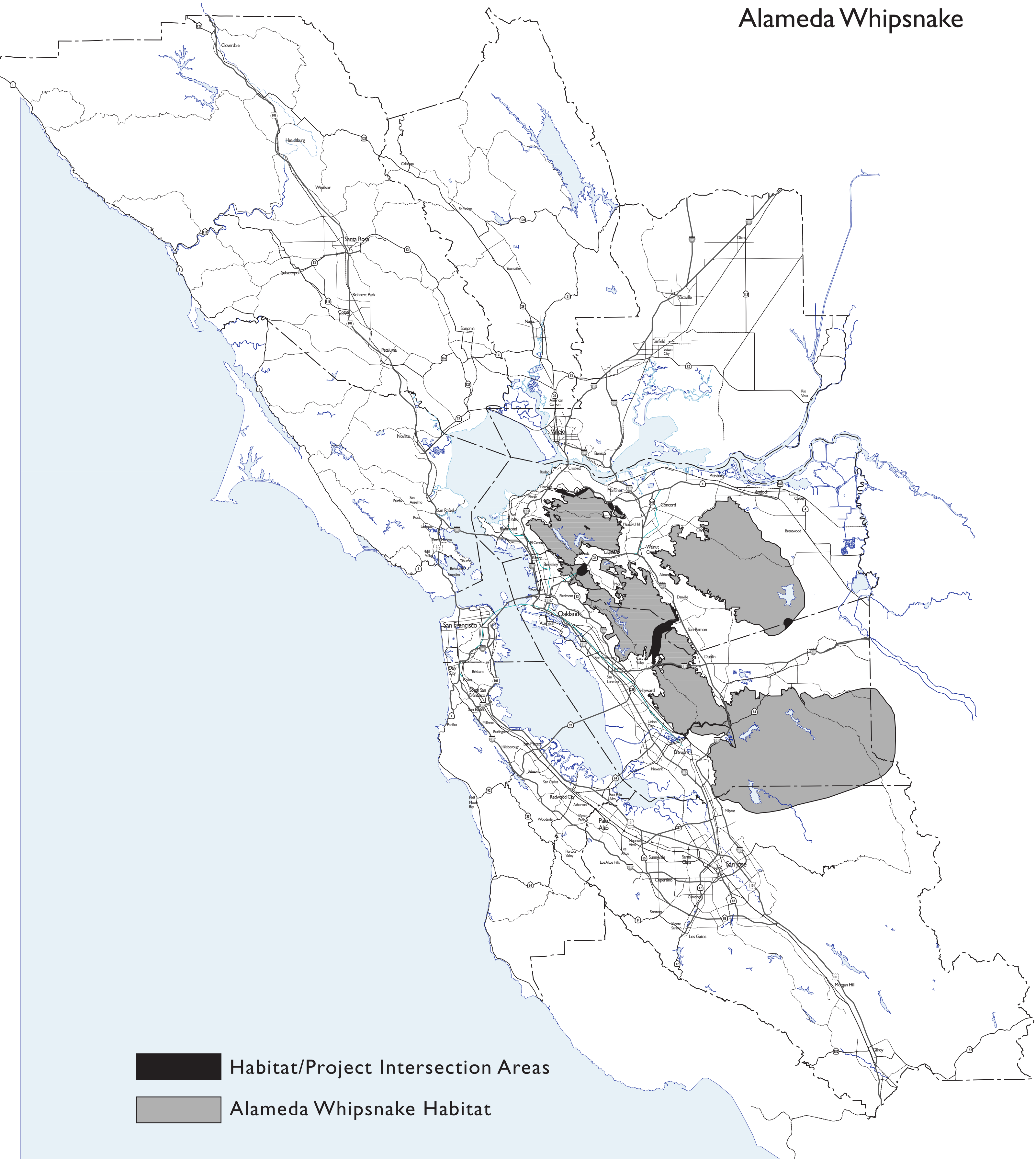
[5] Federal Register. *Endangered and Threatened Wildlife and Plants; Final Determination of Critical Habitat for the Alameda Whipsnake (Masticophis lateralis euryxanthus).* Federal Register, Vol. 65, No. 192, October 3, 2000, p. 58933.

[6] Holland, R.F., P*reliminary Descriptions of the Terrestrial Natural Communities of California*, Department of Fish and Game, Sacramento, CA, 1986.

Figure 2.5-1
Critical Habitat for the Alameda Whipsnake



broadleaf species are quite variable, but often include filaree (*Erodium* sp.), yellow-star thistle (*Centaurea* sp.), lupines (*Lupinus* sp.), peppergrass (*Lepidium* sp.), Indian paintbrush (*Castilleja* sp.), and California poppy (*Eschscholzia californica*). In addition to considerable site-to-site variation that is largely based on soils and management practices, there is also much year-to-year variation in species composition in response to the timing and amount of precipitation. In a standard reference on California vegetation, the non-native annual grassland community is equivalent to the California annual grassland series.[7]

Serpentine bunchgrass and valley needlegrass grasslands are both native vegetation communities with limited distribution in the Bay Area. The former community has limited distribution due to its dependency upon serpentine sites, which are scattered throughout the Coast Ranges. This habitat is known to occur within the Golden Gate corridor, particularly in Marin County, and in the Peninsula corridor near I-280. This open grassland community is dominated by native perennial bunchgrasses of the genera *Bromus, Melica, Nassella, Poa, Calamagrostis,* and *Festuca*. Native herbaceous species on this Serpentine bunchgrass and valley needlegrass grasslands are both native vegetation communities with limited distribution in the Bay Area. The former community has limited distribution due to its dependency upon serpentine sites, which are scattered throughout the Coast Ranges. This habitat is known to occur within the Golden Gate corridor, particularly in Marin County, and in the Peninsula corridor near I-280. This open grassland community is dominated by native perennial bunchgrasses of the genera *Bromus, Melica, Nassella, Poa, Calamagrostis,* and *Festuca*. Native herbaceous species on this habitat type include California poppy, tarweed (*Hemizonia* sp.), and lotus (*Lotus* sp.). Valley needlegrass grasslands usually occur on seasonally moist, fine-textured soils and often intergrade with oak woodland communities. This formerly extensive grasslands habitat is dominated by clump-forming purple needlegrass (*Nassella pulchra*) and a variety of native and introduced grasses and herbs.

Grassland habitats are utilized by a wide variety of wildlife. Reptile species typically found in this habitat include western fence lizard (*Sceloporus occidentalis*), western terrestrial garter snake (*Thamnophis elegans*), and western rattlesnake (*Crotalus viridis*). Mammals within this habitat include black-tailed jackrabbit (*Lepus californicus*), western harvest mouse *(Reithrodontomys megalotis*), California vole (*Microtus californicus*), and coyote (*Canis latrans*). The principal game species in the Bay Area are deer, California quail (*Lophortyx californicus*), and mourning dove *(Zenaida macrovra)*. Typical foraging birds include the turkey vulture (*Cathartes aura*), northern harrier (*Circus cyaneus*), American kestrel (*Falco sparverius*), and white-tailed kite (*Elanus leucurus*).

Special-status plant species that occur in specialized habitat within grasslands include white-rayed pentachaeta (*Pentachaeta bellidiflora*), San Francisco popcorn flower (*Plagiobothrys diffusus*), showy madia (*Madia radiata*), most beautiful jewel-flower (*Streptanthus albidus* ssp. *peramoenus*), Tiburon jewel-flower (*Streptanthus niger*), Tiburon Indian paintbrush (*Castilleja*

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[7] Sawyer and Keeler-Wolf, 1995.

affinis ssp. *neglecta*), Tamalpais lessingia (*Lessingia micradenia* var. *micradenia*), Contra Costa goldfields (*Lasthenia conjugens*), fountain thistle (*Cirsium fontinale* var. *fontinale*), Carquinez goldenbush (*Isocoma arbuta*), Santa Cruz tarplant (*Holocarpha macradenia*), Marin western flax (*Hesperolinon congestum*), Brewer's western flax (*Hesperolinon breweri*), Diablo helianthella (*Helianthella castanea*), diamond-petaled California poppy (*Eschscholzia rhombipetala*), caper-fruited tropidocarpum (*Tropidocarpum capparideum*), and recurved larkspur (*Delphinium recurvatum*). Most of these species also occur in communities other than grassland and are restricted to specific soil types, hydrologic regimes, elevation range, and geographic distribution.

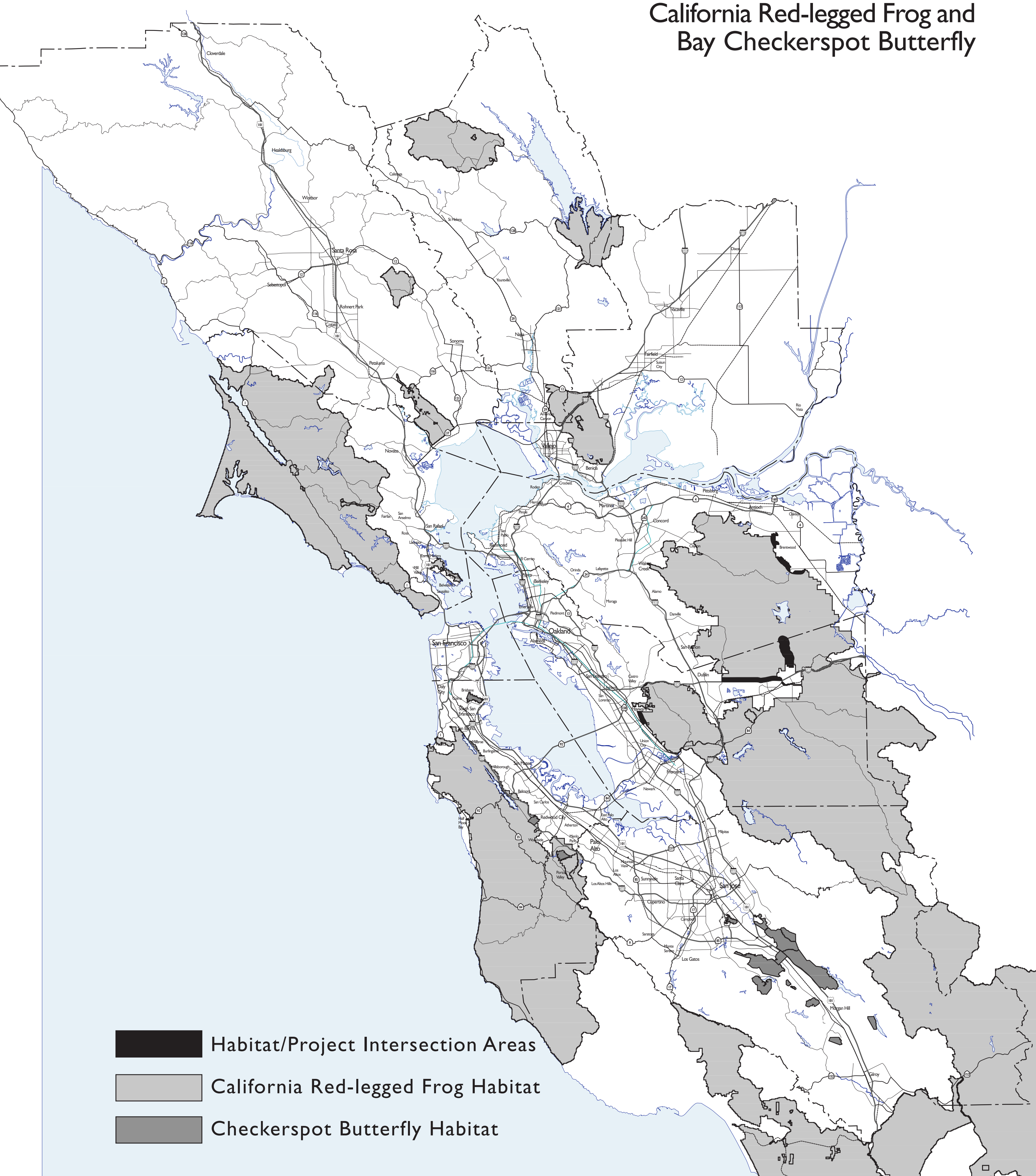
A variety of special-status wildlife species are associated with grassland habitats of the Bay Area, including Bridge's coast range shoulderband snail (*Helminthoglypta nickliniana bridgesi*), callippe silverspot butterfly (*Speyeria callippe callippe*), mission blue butterfly (*Icaricia icarioides missionensis*), and bay checkerspot butterfly (*Euphydryas editha bayensis*), Edgewood blind harvestman (*Calicina minor*), California tiger salamander (*Ambystoma californiense*), western spadefoot toad (*Scaphiopus hammondii*), California red-legged frog (*Rana aurora draytonii*) (discussed under *Riparian* habitat, below), Alameda whipsnake (*Masticophis lateralis euryxanthus*), San Joaquin whipsnake (*Masticophis flagellum ruddocki*), white-tailed kite (*Elanus leucurus*), golden eagle (*Aquila chrysaetos*), burrowing owl (*Athene cunicularia*), loggerhead shrike (*Lanius ludovicianus*), California horned lark (*Eremophila alpestris*), and San Joaquin kit fox (*Vulpes macrotis mutica*). Grassland-associated wildlife species in the Bay Area for which the U.S. Fish and Wildlife Service (USFWS) has designated critical habitat include the bay checkerspot butterfly, Alameda whipsnake (as described above in *Chaparral* habitats), and the California red-legged frog. The distribution of critical habitat for the bay checkerspot butterfly and California red-legged frog within 0.5 mile of proposed 2001 RTP projects is provided in Figure 2.5-2.

Riparian

Riparian plant communities are tree- or shrub-dominated communities that occur along streams and rivers. Riparian forests, woodlands, and scrub are often separated from one another depending on the amount and density of tree canopy versus shrub canopy. Forests support a closed or nearly closed canopy of trees with variable understory, while woodlands have an open canopy of trees with an understory that is primarily grassy or herbaceous. Shrubs rather than trees dominate riparian scrub habitat. The composition and density of riparian vegetation is very much dependent upon the duration of flowing or near-surface water, the amplitude and periodicity of flow (brief, high-velocity flows versus more sustained flows), and the texture of the substrate (cobble, gravel, sand, silt, clay). Different reaches of a stream may support different types of riparian vegetation. The most well-developed riparian vegetation occurs on the largest Bay Area streams, such as Sonoma Creek, the Napa River, Putah Creek, Alameda Creek, Coyote Creek, the Guadalupe River, San Francisquito Creek, Llagas Creek, and others listed in Table 2.5-1. The major rivers, streams, and other surface waters that support riparian vegetation in the Bay Area are presented in Figure 2.6-2 of Chapter 2.6 in this EIR.

Figure 2.5-2

Critical Habitat for the California Red-legged Frog and Bay Checkerspot Butterfly



Typical dominant species in the forests, woodlands, and scrubs along these rivers are Fremont cottonwood (*Populus fremontii*), California sycamore (*Platanus racemosa*), various species of willow (*Salix* spp.), coast live oak (*Quercus agrifolia*), and white alder (*Alnus rhombifolia*). Vegetation series represented in riparian vegetation of the Bay Area include Fremont cottonwood, arroyo willow (*S. lasiolepis*), as well as coast live oak and canyon live oak series. Where not modified by urbanization, lower reaches of the above-described streams typically intergrade into broad freshwater emergent wetlands dominated by cattails and bulrush (*Scirpus* spp.). Where the riparian habitat has been degraded, either through alteration of the hydrology or direct disturbance to the vegetation, the non-native blue gum eucalyptus (*Eucalyptus globulus*), fennel (*Foeniculum vulgare*), giant reed (*Arundo donax*), or French broom (*Genista monspessulana*) are often dominant, as seen in portions of most large Bay Area streams. Most remaining high-quality riparian vegetation is afforded special status by the CDFG.

Within the urbanized portions of the Bay Area, riparian habitats support the densest and most diverse wildlife communities available. The diversity of plant species, multilayered vegetation, and perennial water provides a variety of foods and microhabitat conditions for wildlife. Mature willows, oaks, sycamores, and other riparian trees provide high-quality nesting habitat for wildlife such as raptors. Cavity-nesting wildlife such as the downy woodpecker (*Picoides pubescens*), hairy woodpecker (*P. villosus*), northern flicker (*Colaptes auratus*), oak titmice (*Baeolophus griseus*), white-breasted nuthatch (*Sitta carolinensis*), bats, and western gray squirrels (*Sciurus griseus*) require mature stands of trees. California grape (*Vitis californicus*) vines, blackberries (*Rubus* spp.), elderberries (*Sambucus* spp.), and oaks produce important fall and winter foods for birds and mammals. Common wildlife species that depend on the nectar, fruits, and seeds of riparian plants include Anna's hummingbirds (*Calypte anna*), spotted towhee (*Pipilo maculatus*), California towhee (*Pipilo crissalis*), raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), opossum (*Didelphis marsupialis*), American badger (*Taxidea taxus*), and gray fox (*Urocyon cinereoargenteus*).

Riparian vegetation supports an abundance of insect prey that feed on foliage and stems during the growing season. These insects, in turn, support a high density of migratory and resident birds, including the Pacific-slope flycatcher (*Empidonax difficilis*), western wood pewee (*Contopus sordidulatus*), yellow warbler (*Dendroica petechia*), Townsend's warbler (*D. townsendi*), yellow-rumped warbler (*D. coronata*), Cassin's vireo (*Vireo cassinii*), warbling vireo (*V. gilvus*), bushtit (*Psaltriparus minimus*), and house wren (*Troglodytes aedon*). Raptors (birds of prey) such as sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*A. cooperii*) and red-shouldered hawk (*Buteo lineatus*) nest in the high canopy and feed on the smaller birds and amphibians.

Wildlife species that have declined dramatically or been eliminated from many Bay Area riparian habitats include representatives from all major taxa. The aquatic environment and Bay Area fisheries are discussed in *Rivers and Streams*, below. Invertebrate species are represented by the California freshwater shrimp (*Syncaris pacifica*), a resident of North Bay counties that persists in cool and deep, somewhat overgrown streams such as Sonoma Creek.

California's nesting avifauna in the Bay Area include yellow warbler, yellow-breasted chat (*Icteria virens*), and forest-nesting accipiters such as Cooper's hawk and sharp-shinned hawk. Habitat destruction and fragmentation or nest parasitism by the brown-headed cowbird (*Molothrus ater*) are suspected causes of the two former species' decline. The federally threatened California red-legged frog still breeds in the upper reaches of most Bay Area riparian corridors and in the lower reaches within select drainage systems and ponds. The greatest concentrations of this species in the Bay Area occur near Sears Point (North Bay east-west corridor), several drainages and channels that traverse I-580 in the Livermore-Amador Valley (I-580 corridor), and in drainages on the San Francisco Peninsula (Peninsula corridor), though potential habitat may occur elsewhere. Critical habitat was designated on March 13, 2001 for the California red-legged frog and includes major portions of the East Bay, North Bay, and San Francisco Peninsula.[8] The foothill yellow-legged frog (*Rana boylii*) occurs in the upper, rocky reaches of some North Bay and inner Coast Ranges streams (e.g., at Sunol Regional Park). Due to the absence of Rocky Mountain streams in the Bay Area, this species is not expected in any of the 2001 RTP corridors. The federal and state-listed endangered San Francisco garter snake (*Thamnophis sirtalis tetrataenia*) occurs on the San Francisco Peninsula, where riparian habitats meet open water and freshwater marshlands. Habitats within the Peninsula corridor occur in marshlands near San Francisco International Airport (US 101) and in tributary streams to the Crystal Springs Reservoir (I-280). Riparian habitats in the Bay Area may also support small populations of western pond turtle (*Clemmys marmorata)*. The federally threatened valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) is dependent upon the elderberry bush (*Sambucus* sp., usually *mexicana*) throughout its entire life history. Elderberry bushes occur statewide and commonly occur in riparian corridors, but may also are present in isolated stands or in woodlands outside riparian habitats. The range of the valley elderberry longhorn beetle includes portions of Solano County (I-80 corridor).

Rivers and Streams

Rivers and streams of the Bay Area have several common ecological attributes:

- As a result of urbanization, many smaller streams on the San Francisco Peninsula, south San Francisco Bay, East Bay, and in portions of the North Bay have been channelized or otherwise developed for flood control or agriculture.
- Most of these waterways are small, seasonal streams, and in the case of urbanized streams, many maintain perennial flows from urban runoff sources during late summer months.
- There are a handful of native streams and rivers in each county that account for the majority of freshwater flows to San Francisco Bay and provide the greatest opportunities for special-status plants and wildlife species.

The Bay Area is drained by many small to mid-sized rivers and creeks spread throughout the region (see Table 2.5-1). The Sacramento River Delta contributes the majority of the freshwater input to San Francisco Bay; however, this discussion concentrates other tributaries in the region

[8] Federal Register. 2001. Endangered and Threatened Wildlife and Plants; Final Determination of Critical Habitat for the California Red-legged Frog. Federal Register, Vol. 66, No. 49, March 13, 2001, p. 14625.

that provide important riverine and aquatic habitat. In the North Bay, the Petaluma River, Sonoma Creek, and Napa River account for much of the freshwater flows into San Pablo Bay.

Table 2.5-1: Major Rivers and Creeks in the Bay Area

North San Francisco Bay	
Marin County	Solano County
Gallinas Creek	Napa River
Novato Creek	Green Valley Creek
Corte Madera Creek	Putah Creek
Miller Creek	Suisun Creek
Lagunitas Creek	Sonoma County
Napa County	Sonoma Creek
Napa River	Petaluma River
Huichica Creek	Santa Rosa Creek
East San Francisco Bay	
Alameda County	Contra Costa County
San Leandro Creek	San Pablo Creek
Alameda Creek	
San Lorenzo Creek	
South San Francisco Bay	
Santa Clara County	
Coyote Creek	
Guadalupe River	
Steven's Creek	
Permanente Creek	
Adobe Creek	
San Francisquito Creek	
Los Gatos Creek	
Llagas Creek (drains directly to the Pacific Ocean via the Pajaro River)	
San Francisco Peninsula	
San Mateo County	San Francisco City and County
Cordilleras Creek	None
San Mateo Creek	
Sanchez Creek	

Source: Environmental Science Associates, 2001.

Relatively smaller, though biologically important contributions are made from Gallinas Creek, Novato Creek, Corte Madera Creek, and Miller Creek in Marin County. In general, there are few impediments or obstructions in these creeks, and the watersheds, though developing rapidly, are mostly undeveloped. These tributaries are less channelized, offering habitat for listed native salmonids including coho salmon (central California Evolutionarily Significant Unit, or ESU) and steelhead (central California coast ESU). Solano County watersheds are also relatively undeveloped, including the Putah Creek watershed. Lake Berryessa limits the availability of headwater habitats in Putah Creek to anadromous fish, but this creek still provides valuable aquatic resources.

Stream resources in the East Bay, South Bay, and San Francisco Peninsula have been degraded by urban development, particularly adjacent to and within stream courses. As a result of these changes, only a handful of major streams in these areas support native fisheries and special-status fisheries. These include Alameda Creek, which drains the largely undeveloped Livermore-Amador Valley, Coyote Creek, Guadalupe River, and Los Gatos Creek in the South Bay, and San Francisquito Creek, Permanente Creek, and San Mateo Creek on the San Francisco Peninsula. In Gilroy and Morgan Hill, Llagas Creek transports flows southward to the Pajaro River. Among these, major dams or other fish impediments that prevent fish from reaching the upper watersheds are present in all streams, with the exception of San Francisquito Creek.

Common fish species that have been identified in the lower, freshwater reaches of larger Bay Area creeks can be classified into the Sacramento blackfish – introduced fishes association. Such species include Sacramento perch (*Archoplites interruptus*), splittail (*Pogonichthys macrolepidotus*), hitch (*Lavinia exilicauda*), tule perch (*Hysterocarpus traski*), Sacramento blackfish (*Orthodon microlepidotus*), Pacific lamprey (*Lampetra tridentata*), and Sacramento sucker (*Catostomus occidentalis*). These are often joined by the introduced largemouth bass and smallmouth bass (*Micropterus* spp.), goldfish (*Carassius auratus*), carp (*Cyprinus carpio*), bluegill, and green sunfish (*Lepomis* sp.), which can be found where there is year-round water, as well as mosquitofish (*Gambusia affinis*). Several catfish, including black bullhead (*Ictalurus melas*), brown bullhead (*Ictalurus nebulosus*), and channel catfish (*Ictalurus punctatus*), are widely distributed, especially in the warm lower reaches of Bay Area rivers and creeks. The Sacramento perch and Pacific sucker are both federal species of concern and California species of special concern.

Habitat for these species occurs primarily in those streams listed in Table 2.5-1, though other streams in the Bay Area can and do support these species. Special-status fish are less common in rivers and streams of the Bay Area. These include the federally listed tidewater goby (*Eucyclogobius newberryi*), coho salmon–central California ESU (*Oncorhynchus kisutch*), steelhead–central California ESU (*Oncorhynchus mykiss*), Chinook salmon (*Oncorhynchus tshawytscha*), and Sacramento splittail (*Pogonichthys lucius*). Several species of limited distribution and rarity occur exclusively in the lower reaches of drainages near and within the Delta, such as longfin smelt (*Spirinichus thaleichthys*) and the state- and federally listed threatened Delta smelt (*Hypomesus transpacificus*). Llagas Creek crosses US 101 in the southern Santa Clara Valley subarea and, though dry seasonally, supports steelhead within the South/Central California ESU.

The federally listed endangered California freshwater shrimp (*Syncaris pacifica*) occurs in low gradient, structurally diverse perennial streams in the northern Bay Area.[9] Of the 17 streams that support this species, those in the Bay Area include Sonoma Creek, the Napa River, and Huichica Creek, which drain to San Pablo Bay; and Laguna de Santa Rosa (Santa Rosa Creek) and its

[9] U.S. Fish and Wildlife Service. 1998. California Freshwater Shrimp (*Syncaris pacifica*) Recovery Plan. U.S. Fish and Wildlife Service, Portland, Oregon, 94 pp.

tributaries, which drain to the Russian River. The 1998 Recovery Plan for this species seeks the long-term protection of aquatic and riparian habitat as criteria for species delisting.

Suitable steelhead and coho spawning habitat is found in streams and rivers where there is less development. Steelhead require higher gradient, upper reaches of streams, with access to the ocean during emigration and spawning, and cool year-round water temperatures for the juveniles' rearing habitat. Known populations of steelhead occur in San Francisquito Creek, Guadalupe River, Coyote Creek, Sonoma Creek, Napa River, Putah Creek, and possibly in Alameda Creek. Several small, cool-water drainages in Marin County support coho salmon, which apparently do not successfully reproduce south of the Golden Gate.[10] Steelhead are known to sporadically migrate into and occasionally breed in small streams throughout the Bay Area.

Bridges of various rivers and streams provide nesting opportunities for the nonlisted barn swallow (*Hirundo rustica*) and cliff swallow (*Petrochelidon pyrrhonota*), which are protected under the Migratory Bird Treaty Act. These species build cup- and gourd-shaped nests, respectively, using mud as their primary construction material.

SAN FRANCISCO BAY AQUATIC RESOURCES

The San Francisco Bay and Delta make up the Pacific Coast's largest estuary, encompassing roughly 1,600 square miles of waterways and draining over 40 percent of California's fresh water. The Sacramento and San Joaquin Rivers flow from Northern California's inland valleys into the Delta's winding system of islands, sloughs, canals, and channels, before emptying into San Francisco Bay and the Pacific Ocean. Six project corridors bridge the open waters of San Francisco Bay, and many others are located in close proximity to the Bay.

The marine environment varies widely between the six travel corridors that cross the open waters of the San Francisco Bay. Most of the transbay corridors consist of open water habitat; that is, habitat below the low-tide line (also known as subtidal habitat).

Eelgrass (*Zostera marina*) may occur near the footings of bridges in the transbay corridors and is considered a sensitive habitat by CDFG. Eelgrass is an important habitat for many organisms and may influence benthic community structure by stabilizing sediments, providing forage and detritus food sources, and creating a refuge and nursery for small organisms. Eelgrass beds also provide an important attachment substrate for Pacific herring eggs.[11]

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[10] Federal Register. 1999. Designated Critical Habitat for Central California Coast and Southern Oregon/Northern California Coasts Coho Salmon. Federal Register, Vol. 64, No. 86, May 5, 1999, p. 24049.

[11] U.S. Fish and Wildlife Service. 1994. *The Ecology of Eelgrass Meadows in the Pacific Northwest: A Community Profile.* FWS/OBS-84/24, September 1984, 85 pp.

More than 100 species of fish are described from the San Francisco Bay system.[12] The majority of these are native species that live year-round in San Francisco Bay, though a few, such as striped bass (*Morone saxatilis*), have been introduced. Anadromous fish use San Francisco Bay seasonally during their migrations to and from spawning grounds throughout the Bay Area and in the California's Central Valley.

Common fish species in San Francisco Bay include topsmelt (*Atherinops affinis*), Pacific herring (*Clupea pallasi*), northern anchovy (*Engraulis mordax*), rock sole (*Lepidosetta bilineata*), English sole (*Parophrys vetulus*), jacksmelt (*Atherinopsis californiensis*), white croaker (*Genyonemus lineatus*), and shiner perch (*Cymatogaster aggregata*). The northern anchovy, topsmelt, and jacksmelt provide an important food source for piscivorous (fish eating) fish and birds.

The two marine mammals most commonly found in San Francisco Bay are the California sea lion (*Zalophus californianus*) and the harbor seal (*Phoca vitulina*). Both species forage in the open waters of the Bay and bask on exposed rocks, piers, or wharves throughout the Bay. Both species are protected by the Marine Mammal Protection Act.

The USFWS recognizes several threatened and endangered species that occur in San Francisco Bay. These include the Steller sea-lion (*Eumetopias jubatus*), the loggerhead sea turtle (*Caretta caretta*), leatherback turtle (*Dermochelys coriacea*), olive ridley sea turtle (*Lepidochelys olivacea*), and several fish species, including coho salmon–central California ESU, steelhead–central California coast ESU, tidewater goby, delta smelt, Pacific lamprey, and Sacramento splittail. The four later species are native residents; the other species, however, are expected to use open water habitats either seasonally or infrequently.

POLICY AND REGULATION

The regulations and policies of various federal and state agencies (e.g., U.S. Army Corps of Engineers [Corps], U.S. Environmental Protection Agency [EPA] and USFWS) mandate protection of wetlands, special-status plant and wildlife species, and aquatic and terrestrial communities in the MTP region. The Corps has primary federal responsibility for administering regulations that concern waters and wetlands, while the USFWS, National Marine Fisheries Service, and the CDFG have lead responsibility for determining potential project effects on federal- and state-listed species and other species of concern. A complete survey of agencies responsible for ensuring compliance with state and federal regulations is provided in Appendix D.

[12] U.S. Fish and Wildlife Service. 1983. *The Ecology of San Francisco Bay Tidal Marshes: A Community Profile*. FWS/OBS-83/23, October, 1983.

CRITERIA OF SIGNIFICANCE

This EIR uses the following criteria to assess whether proposed improvements in the 2001 RTP would have a significant adverse effect on biological resources:

- **Criterion 1: Natural vegetation.** Implementation of the 2001 RTP would have a potentially significant impact if transportation projects occur in areas of natural vegetation, potentially resulting in impacts on wildlife movement, disruption of wildlife corridors, or effects on native wildlife nurseries.
- **Criterion 2: Wetlands and Aquatic Resources.** Implementation of the 2001 RTP would have a potentially significant impact if transportation projects occur near or adjacent to an identified aquatic resource (i.e., riparian, riverine, coastal, or wetland).
- **Criterion 3: Special-Status Species.** Implementation of the 2001 RTP would have a potentially significant impact if transportation projects occur near or within the designated or known habitat of a special-status plant or animal species.

METHOD OF ANALYSIS

For this impact assessment, the locations of projects in the 2001 RTP were compared with locations of sensitive species and important habitat areas. Potential impacts were determined by evaluating whether proposed transportation improvements would occur within the potential range of a special-status species of concern, whether the projects would directly encroach upon an area of ecological significance, or whether the projects could involve the filling of wetlands. Impacts would be more likely to occur where projects could have an effect upon ecologically sensitive or significant areas. Projects involving significant ground-disturbing activity were reviewed with the closest scrutiny, including road widenings, highway extensions, interchange projects, bridges and rail extensions. Resources used to identify these potential impacts included the California Natural Diversity Database, National Wetland Inventory Maps, city and county master plans, published environmental impact reports, or other CEQA/NEPA documents. In many cases, the project alignments, locations, or other design details are not known because the projects are in the early stages of planning or development. The analysis therefore assesses only the potential for biological impacts. Laws and regulations protecting special-status species, areas of ecological significance, and wetland resources are effective incentives for project proponents to design alternatives which either avoid or substantially reduce impacts on these resources.

Projects that would not expand transportation-dedicated lands were assumed to have minimal potential biological impacts. These projects include signal and traffic operational improvements, rail extensions along existing rights-of-way, and road widenings in urban areas or within existing rights of way. However, it is recognized that CEQA may require more detailed evaluations on a project-by-project basis to determine the exact resources found within proposed road or rail alignments. Since the specific details of many projects are not yet known, this assessment identifies general locations of potential adverse effects.

SUMMARY OF IMPACTS

Project-specific studies could be required to determine significant impacts to biological resources resulting from implementation of transportation improvements in the 2001 RTP. However, general impacts can be identified at this early stage based on the location of proposed projects and the known distribution of sensitive biological receptors. Projects located near wetland habitats, sensitive natural communities, or near known populations of special-status plant or wildlife species are most likely to impact biological resources. However, because of the wide range of special-status plant and wildlife habitats, from disturbed ruderal areas to high-quality grasslands and riparian habitats, no single generalization can cover all species. Implementation of transportation improvements in the 2001 RTP would increase roadway footprints in the Bay Area and could incrementally impact adjacent wetlands, forested areas, grasslands, and other areas and the associated plant and wildlife species.

DIRECT IMPACTS

Short Term Impacts

Short-term impacts resulting from completion of 2001 RTP transportation improvements include the temporary loss and/or degradation of wetlands, sensitive natural communities, and special-status plant and wildlife species. Such impacts could result from construction disturbances, or from erosion or other indirect project effects.

Long Term Impacts

Direct impacts to sensitive natural communities are considered to have a long-term effect on both common and special-status plant and wildlife species found in sensitive natural communities. This impact is due, in part, to the difficulty in constructing successful habitat replacement for natural areas such as wetlands, riparian forests, and native grasslands. At least eight proposed transportation improvements in the 2001 RTP have been identified within coastal marsh and/or estuarine habitats, which could decrease habitat and result in significant long-term impacts to special-status plant and wildlife species. Other proposed transportation projects could also contribute incrementally to habitat loss for special-status plant or wildlife species.

Changes in the volume of vehicular traffic, and development of new roads in rural grasslands (e.g., near State Route 4) are expected to result in increased casualties to common and special-status wildlife species. This effect would be most pronounced in rural areas, which traverse marshland and grassland habitats. Such changes could also affect the volume of grease, oil, gasoline, and other contaminants entering Bay Area streams and San Francisco Bay and have deleterious effects on fisheries.

INDIRECT/CUMULATIVE IMPACTS

Implementation of transportation improvements in the 2001 RTP could result in indirect impacts to biological resources by accommodating urban development that could, when it occurs, have the potential to significantly impact biological resources by degrading wetlands and other sensitive natural communities and affecting special-status plant and wildlife species. In addition, by improving regional mobility, transportation improvements in the 2001 RTP, when viewed cumulatively with other regional development projects, could serve planned development of rural environs – east Contra Costa County, southern Santa Clara County, the US 101 corridor in Marin and Sonoma counties, etc. Since these indirect impacts on biological resources are associated with forecast urban development in the Bay Area, they could also be considered a cumulative effect. In addition, other transportation improvements in the 2001 RTP not identified as having a direct impact on biological resources in the regional context may result in individually minor impacts locally. Collectively, these individually minor impacts on biological resources may become significant over time.

SIGNIFICANT IMPACTS AND MITIGATION MEASURES

IMPACT

2.5-1 Transportation improvements in the 2001 RTP could adversely affect sensitive biological resources, including wetlands and aquatic resources.

Impacts include the temporary or permanent loss of wetlands or wetland functioning, incremental degradation of wetland habitats, or segmentation of habitats. Wetland resources in the immediate vicinity of proposed transportation improvements vary from relatively small, isolated roadside areas, wet meadows, and vernal pools to major streams and rivers, and vegetated shorelines. Any fill of significant wetland habitats associated with proposed transportation improvements would be considered a significant impact.

In addition to the direct loss of habitat, implementation of proposed transportation projects could increase the potential for stormwater runoff to carry a variety of pollutants into wetlands, rivers, streams, and San Francisco Bay. Construction runoff often carries grease, oil, and heavy metals (due to ground disturbance) into natural drainages. Furthermore, particulate materials generated by construction could be carried by runoff into natural waterways and could increase sedimentation impacts.

MITIGATION

Project sponsors shall demonstrate compliance with the provisions of CEQA and NEPA, as applicable, prior to project approval by the MTC. At the time of project certification, project sponsors shall agree to comply with mitigation measures to protect special-status plant and wildlife species. This requirement obligates project sponsors to implement measures that avoid, minimize, and compensate for significant impacts to special-status species and their habitat. In accordance with guidelines of the Army Corps of Engineers (Corps), the Environmental Protection Agency (EPA), U.S. Fish and Wildlife Service (USFWS), and California Department of Fish and Game (CDFG), a goal of “no net loss” of wetland acreage and value will be implemented, wherever possible, through avoidance of the resource. Mitigation for wetlands impacts due to proposed transportation projects would be based on project-specific wetland mitigation plans, subject to approval by the Corps and commenting agencies. Mitigation for placing fill in wetlands would be partially achieved by avoiding wetlands, and by minimizing fill where avoidance is not feasible.

SIGNIFICANCE AFTER MITIGATION

Avoidance, compensatory restoration, or creation of new wetland communities to offset the conversion of wetlands for proposed transportation improvements would achieve "no net loss" of wetland acreage and value. Implementing the above mitigation on a site-by-site basis would reduce project effects to a less-than-significant level.

IMPACT

2.5-2 Transportation improvements in the 2001 RTP could cause substantial disturbance of biologically unique or sensitive communities, including CDFG-recognized protected plant communities.

Proposed transportation projects located near or adjacent to protected plant communities could cause an incremental loss of these community types and would constitute a significant impact. State-protected vegetation or natural communities in the region include serpentine chaparral, northern maritime chaparral, coastal terrace prairie, serpentine bunchgrass, freshwater seeps, northern coastal salt marsh, coastal brackish marsh, coastal freshwater marsh, riparian forest (several), California bay forest, and eelgrass beds.[13]

MITIGATION

In accordance with guidelines of the Corps, EPA, USFWS, and CDFG, a goal of "no net loss" shall be achieved through avoidance of the resource, or through creation or restoration of habitat of superior or comparably quality. Where applicable, projects shall conform to the provisions of special area management or restoration plans such as the Suisun Marsh Protection Plan.

SIGNIFICANCE AFTER MITIGATION

Avoidance, compensatory restoration, or creation of sensitive natural communities for proposed transportation improvements could achieve the minimum overall goal of "no net loss" of wetland acreage and value. Implementing the above mitigation on a site-by-site basis would reduce project effects to a less-than-significant level.

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[13] Holland, 1986.

IMPACT

2.5-3 Proposed transportation improvements in the 2001 RTP could have deleterious impacts on special-status plant and wildlife species identified as endangered, candidate, and/or special status by the CDFG or USFWS, or on designated critical habitat for listed species.

For the purposes of this analysis, unless shown to be absent, special-status species are presumed present in all areas that provide at least moderate quality habitat. Special-status species with the greatest potential to be impacted by proposed transportation projects in the 2001 RTP are listed in Table D-1 in Appendix D. Potential effects to special-status species include the temporary removal of vegetation and habitat, direct mortality from equipment, loss or degradation of designated critical habitat, entrapment in open trenches, and general disturbance due to noise or vibration during pile-driving, earthmoving, and other construction activities. Additional impacts to special-status species could occur as a result of habitat fragmentation, increased human intrusion, erosion, introduction of invasive species, disruption of migratory corridors, sedimentation, filling and disturbance of aquatic habitats, and general reduction in biological diversity.

To the extent that the 2001 RTP supports planned conversion of currently undeveloped and rural land development, it would, along with other infrastructure improvements, have significant cumulative regionwide impacts on biological resources. Areas that would be affected include the North Bay (Napa, Solano, and Sonoma Counties), the Livermore-Amador Valley, Central Valley, and Santa Clara Valley. Potential cumulative effects include the hastened incremental loss and urbanization of habitat for the California red-legged frog, and California tiger salamander, among other species.

MITIGATION

Project sponsors shall demonstrate compliance with the provisions of CEQA and NEPA, as applicable, prior to project approval by the MTC. At the time of project certification, project sponsors shall agree to comply with mitigation measures to protect special-status plant and wildlife species. This requirement obligates project sponsors to implement measures that avoid, minimize, and compensate for significant impacts to special-status species and their habitat. Typical measures that may be included by project sponsors include:

- In support of CEQA, NEPA, and CDFG and USFWS permitting processes for individual 2001 RTP transportation projects, biological and wetland surveys shall be conducted as part of the environmental review process to determine the presence and extent of sensitive habitats and/or species in the project vicinity. Surveys shall follow established methods and shall be undertaken at times when the subject species is most likely to be identified. In cases where impacts to state- or federal-listed plant or wildlife species are imminent, formal protocol-level surveys may be required on a species-by-species basis to determine the local distribution of these species. Consultation with the USFWS shall be conducted at an informal level for transportation projects that could adversely affect federal candidate, threatened, or endangered species to determine the need for further consultation or permitting actions.

- Project designs shall be reconfigured, whenever possible, to avoid sensitive wetland or biological resources and avoid disturbances to wetland and riparian corridors. Projects shall minimize ground disturbances and construction footprints near sensitive areas to the extent practicable.

- To the extent practicable, project activities in the vicinity of sensitive resources shall be completed during the period that best avoids disturbance to plant and wildlife species present (e.g., May 15 to October 15 near salmonid habitat and vernal pools).

- Individual projects shall minimize the use of in-water construction methods in areas that support sensitive fish species, especially when fish are present.

- In the event that equipment needs to operate in any watercourse with flowing or standing water, a qualified biological resource monitor shall be present at all times to alert construction crews to the possible presence of California red-legged frog, nesting birds, salmonids, or other aquatic species at risk during construction operations.

- Construction periods shall not occur during the breeding season near riparian habitat, freshwater marshlands, and salt marsh habitats that support special-status nesting bird species (e.g., yellow warbler, tricolored blackbird *[Agelaius tricolor]*, or California clapper rail).

- Biological monitors shall locate and fence off sensitive resources before construction activities begin and, where required, shall inspect areas to ensure that barrier fencing, stakes, and setback buffers are maintained during construction.

- For work sites located adjacent to special-status plant or wildlife populations, a biological resource education program shall be provided for construction crews and contractors (primarily crew and construction foremen) before construction activities begin.

- Biological monitoring shall be particularly targeted for areas near identified habitat for federal- and state-listed species, and a "no take" approach shall be taken whenever feasible during construction near special-status plant and wildlife species.

SIGNIFICANCE AFTER MITIGATION

Since proposed transportation improvements are concentrated along existing transportation corridors, the overall habitat loss and fragmentation is considered lower than if projects were more dispersed. However, the implementation of the above mitigation measures may not eliminate or reduce the impacts of individual projects to a less-than-significant level. Cumulative impacts to special-status wildlife species as a result of transportation infrastructure improvements is considered significant and unavoidable.

IMPACT

2.5-4 Construction activities could adversely affect nonlisted nesting raptor species.

Nesting habitat for several nonlisted raptor species could occur near a number of proposed transportation projects. Construction disturbance during the breeding season could result in the incidental loss of fertile eggs or nestlings, or otherwise lead to nest abandonment. Disturbance that causes nest abandonment and/or loss of reproductive effort is considered a "taking" by the CDFG and would be considered a significant impact. Nesting habitat for northern harrier, white-tailed kite, Cooper's hawk, and sharp-shinned hawk are present in grasslands and riparian habitats in the MTC region. Additionally, red-shouldered hawk, red-tailed hawk, American kestrel, barn owl, great horned owl, and western screech owl may breed in riparian habitats. Nesting habitat for golden eagle may occur in open grasslands of the Diablo Range and Vaca Range in Napa, Solano, Contra Costa, and Alameda Counties.

MITIGATION

Project sponsors shall demonstrate compliance with the provisions of CEQA and NEPA, as applicable, prior to project approval by the MTC. At the time of project certification, project sponsors shall agree to comply with mitigation measures to avoid and minimize impacts to nesting raptors. Typical measures that may be included by project sponsors include:

- To avoid and minimize impacts to nesting raptors, preconstruction surveys would be performed prior to initiating construction activities during the breeding season (February 1 through August 31). If it is determined that young have fledged and are self-sufficient, no further mitigation would be required.

- To avoid and minimize potential impacts to nesting raptors, a no-disturbance buffer zone would be established around active nests during the breeding season.

- The size of individual buffers could be adjusted based on an evaluation of the site by a qualified raptor biologist.

SIGNIFICANCE AFTER MITIGATION

Implementing the above mitigation measures would allow early recognition of nesting raptors in and near work areas and avoid impacts to these species. Following implementation of seasonal avoidance methods, this impact is considered less than significant.

IMPACT

2.5-5 Construction activities could impact nonlisted nesting birds species protected under the federal Migratory Bird Treaty Act.

Nesting habitat for nonlisted birds protected under the federal Migratory Bird Treaty Act occurs in woodlands, riparian areas, and other areas, and may occur near some MTC projects. Construction disturbance during the breeding season could result in the incidental loss of fertile eggs or nestlings, or otherwise lead to nest abandonment, and would be considered a significant impact.

MITIGATION

Project sponsors shall demonstrate compliance with the provisions of CEQA and NEPA, as applicable, prior to project approval by the MTC. At the time of project certification, project sponsors shall agree to comply with mitigation measures to avoid impacts to nesting bird species protected under the federal Migratory Bird Treaty Act, as follows:

- Concurrent with surveys described in Mitigation Measure 2.5-4, surveys shall be performed for migratory birds listed in the federal List of Migratory Birds (50 Code of Federal Regulations, Chapter 1, Part 10 §10.13). More than 500 native and migratory bird species are protected by this statute. If protected breeding birds are detected during surveys, a buffer zone, depending upon the species identified, shall be established around active nesting sites in coordination with CDFG.

SIGNIFICANCE AFTER MITIGATION

This mitigation measure would be expected to reduce this potentially significant impact on nonlisted nesting bird species protected under the federal Migratory Bird Treaty Act to a less-than-significant level if incorporated by project sponsors.

IMPACT

2.5-6 Construction activities could cause mortality of common wildlife species.

MITIGATION

No mitigation is required for this impacts; however, the implementation of feasible mitigation measures for Impacts 2.5-1 and 2.5-2 above would further lessen this project impact.

SIGNIFICANCE AFTER MITIGATION

These mitigation measures would be expected to reduce this potentially significant impact on wildlife species to a less-than-significant level if incorporated by project sponsors.

CUMULATIVE IMPACT

2.5-7 Forecast urban development that would be served by transportation improvements in the 2001 RTP, combined with improved regional mobility provided by the 2001 RTP, could contribute to the conversion of undeveloped land to urban uses, resulting in the removal or fragmentation of habitat area.

Since these indirect impacts on biological resources are associated with forecast urban development in the Bay Area, they could also be considered a cumulative effect. In addition, other transportation improvements in the 2001 RTP not identified as having a direct impact on biological resources in the regional context may result in individually minor impacts locally.

Collectively, these individually minor impacts on biological resources may become significant over time.

MITIGATION

As the cumulative impacts of the transportation improvements in the 2001 RTP are the same as the direct impacts listed above, the mitigation measures for this impact would also be the same.

SIGNIFICANCE AFTER MITIGATION

These mitigation measures would be expected to reduce this potentially significant cumulative impact on wildlife species to a less-than-significant level if incorporated by project sponsors.

2.6 Water Resources

This chapter analyzes the surface water and groundwater resources of the Bay Area in relation to the location of projects comprising the 2001 RTP. The potential effects of the 2001 RTP on these resources are identified as are mitigation measures that may reduce those effects to a less-than-significant level.

SETTING

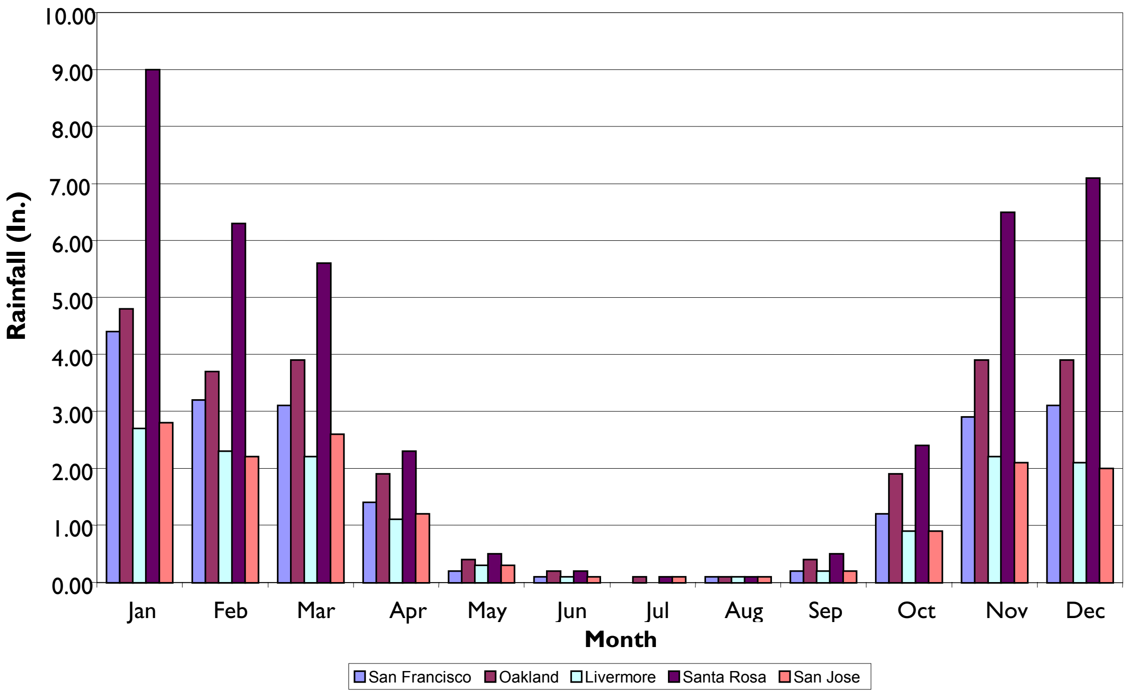
CLIMATE

Much of California enjoys a Mediterranean climate with cool, wet winters and warm, dry summers. Most of the region's moisture originates in the Pacific Ocean as high pressure shifts southward in the winter. The warm valley brings moisture from the ocean in the form of cooling fog to San Francisco in the summer. Climate within the Bay Area varies significantly depending on topographic conditions and proximity to the ocean. The coastal areas have mild, rainy winters and mild, foggy summers, while the inland areas experience more extreme variation between winter low and summer high temperatures. Annual rainfall in the Bay Area can range from 8 to 9 inches per year in the inland valleys to as much as 24 inches in the coastal hills and northern reaches of the region. Table 2.6-1 and Figure 2.6-1 show the disparity of average precipitation within the Bay Area. Approximately 95 percent of the annual precipitation in the Bay Area occurs between October and April. Flooding can occur in urban creeks and streams during more intense rainstorms.

REGIONAL PHYSIOGRAPHY

The San Francisco Bay Delta system is generally regarded as the most important water system in California. Runoff from about 40 percent of the land in California (60,000 square miles) and 47 percent of the state's total runoff, drains from the Sacramento and San Joaquin Rivers into San Francisco Bay. More than 90 percent of runoff occurs during the winter and spring months. San Francisco Bay encompasses approximately 1,600 square miles and is surrounded by the nine Bay Area counties. The drainage basin that contributes surface water flows directly to the Bay covers a total area of 3,464 square miles. The largest subbasins include Alameda Creek (695 square miles), the Napa River (417 square miles), and Coyote Creek (353 square miles). The San Francisco Bay estuary includes deep-water channels, tidelands, and marshlands that provide a variety of habitats for plants and animals. The salinity of the water varies widely as the landward flows of saline water and the seaward flows of fresh water converge near the Benicia Bridge. The salinity levels in the Central Bay can vary from near oceanic levels to one-quarter as much, depending on the volume of freshwater runoff.

Figure 2.6-1: Average Monthly Rainfall for Selected Areas



Source: www.weather.com/weather/climatology

Table 2.6-1: Monthly Average Precipitation from Selected Areas Within the Bay Area (inches)

	Jan	*Feb*	*Mar*	*April*	*May*	*June*	*July*	*Aug*	*Sept*	*Oct*	*Nov*	*Dec*	*Annual*
San Francisco	4.40	3.20	3.10	1.40	0.20	0.10	0.00	0.10	0.20	1.20	2.90	3.10	19.90
Oakland	4.80	3.70	3.90	1.90	0.40	0.20	0.10	0.10	0.40	1.90	3.90	3.90	25.20
Concord	4.50	2.60	3.40	1.60	0.40	0.10	0.10	0.10	0.40	1.50	3.40	3.50	22.60
Livermore	2.70	2.30	2.20	1.10	0.30	0.10	0.00	0.10	0.20	0.90	2.20	2.10	14.20
Santa Rosa	9.00	6.30	5.60	2.30	0.50	0.20	0.10	0.10	0.50	2.40	6.50	7.10	40.60
San Jose	2.80	2.20	2.60	1.20	0.30	0.10	0.10	0.10	0.20	0.90	2.10	2.00	14.60

Source: www.weather.com/weather/climatology.

SURFACE WATERS

Surface waters in the Bay Area include freshwater rivers and streams, coastal waters, and estuarine waters. Estuarine waters include the San Francisco Bay Delta from the Golden Gate to the Sacramento and San Joaquin Rivers, and the lower reaches of various streams that flow directly into the Bay, such as the Napa and Petaluma Rivers in the North Bay and the Coyote and San Francisquito Creeks in the South Bay. Major water bodies, including creeks and rivers, in the Bay Area are presented in Figure 2.6-2.

GROUNDWATER

Groundwater basins are closely linked to local surface waters. As water flows from the hills toward the Bay, it percolates through permeable soils into the groundwater basins. The ten primary groundwater basins in the Bay Area are the Petaluma Valley, Sonoma Valley, Suisun-Fairfield Valley, San Joaquin Valley, Clayton Valley, Diablo Valley, San Ramon Valley, Livermore Valley, and Santa Clara Valley basins.

POLICY AND REGULATION

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD AND REGIONAL WATER QUALITY CONTROL BOARDS

The U.S. Environmental Protection Agency (EPA) is the federal agency responsible for water quality management and administration of the federal Clean Water Act. The EPA has delegated most of the administration of the Clean Water Act in California to the California State Water Resources Control Board (SWRCB). The SWRCB was established through the California Porter-Cologne Water Quality Act of 1969 and is the primary state agency responsible for water quality management issues in California. Much of the responsibility for implementation of the SWRCB's policies is delegated to the nine Regional Water Quality Control Boards (RWQCB). The Bay Area encompasses portions of three separate RWQCBs: North Coast Region #1, San Francisco Bay Region #2, and the Sacramento-based Central Valley Region #5.

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM PERMITS

Section 402 of the Clean Water Act established the National Pollutant Discharge Elimination System (NPDES) to regulate discharges into "navigable waters" of the United States. The EPA authorized the SWRCB to issue NPDES permits in the state of California in 1974. The NPDES permit establishes discharge pollutant thresholds and operational conditions for industrial facilities and wastewater treatment plants. Nonpoint-source NPDES permits are also required for municipalities and unincorporated communities of populations greater than 100,000 to control urban stormwater runoff. These municipal permits include Storm Water Management Plans (SWMP), which reflect the environmental concerns of the local community.

A key part of the SWMP is the development of best management practices (BMPs) to reduce pollutant loads. Certain businesses and projects within the jurisdictions of these municipalities are required to prepare Storm Water Pollutant Prevention Plans (SWPPP), which establish the appropriate BMPs to gain coverage under the municipal permit. On October 29, 1999, the EPA finalized the Storm Water Phase II rule, which requires smaller urban communities with a population of less than 100,000 to acquire individual stormwater discharge permits. The Phase II rule also requires permits for stormwater discharges from construction activities on one to five acres.

Individual stormwater NPDES permits are required for specific industrial activities and for construction sites greater than five acres. Statewide general stormwater NPDES permits have been developed to expedite discharge applications. They include the statewide industrial permit and the statewide construction permit. A prospective applicant may apply for coverage under one of these permits and receive waste discharge requirements from the appropriate RWQCB. Waste discharge requirements establish the permit conditions for individual dischargers.

Total Maximum Daily Loads (TMDL)

Section 303(d) of the Clean Water Act requires the SWRCB to list impaired water bodies in the State and to determine total maximum daily loads (TMDL) for pollutants and other stressors that affect water quality. The California 303(d) list was completed in March 1999. TMDLs have yet to be determined for most of the identified impaired water bodies, although a priority schedule has been developed to complete the process in the region within 13 years.

The RWQCBs will be responsible for ensuring that total discharges do not exceed TMDLs for individual water bodies as well as for entire watersheds. Figure 2.6-2 shows the location of surface waters in the Bay Area, such as lakes, reservoirs, rivers, and streams. Figure 2.6-3 shows the location of Section 303(d) impaired water bodies in the Bay Area.

The RWQCBs also coordinate the State Water Quality Certification Program, or Section 401 of the Clean Water Act. Under Section 401, states have the authority to review any permit or license that will result in a discharge or disruption to wetlands and other waters under state jurisdiction, to ensure that the actions are consistent with the state's water quality requirements. This program is most often associated with Section 404 of the Clean Water Act, which obligates the U.S. Army Corps of Engineers to issue permits for the movement of dredge and fill material into and from "waters of the United States." Additionally, Section 404 requires permits for activities that affect wetlands or alter hydrologic features, such as wetlands, rivers, or ephemeral creekbeds.

REGIONAL WATER QUALITY MANAGEMENT

The quality of regional surface water and groundwater resources is affected by point-source and nonpoint-source discharges throughout individual watersheds. Regulated point sources such as wastewater treatment effluent discharges usually involve a single discharge into receiving waters. Nonpoint sources involve diffuse and nonspecific runoff that enters receiving waters through storm drains or from unimproved natural landscaping. Common nonpoint sources include urban runoff, agricultural runoff, resource extraction (ongoing and historical), and natural drainage. Pollutants that enter water bodies in urban runoff include oil and gasoline by-products from parking lots, streets, and freeways. Copper from brake linings and lead from counterweights contribute heavy metals to local waters. In addition, impervious surfaces increase runoff quantities, taxing flow capacities of local flood control systems and deteriorating natural habitats.

Within the regional Basin Plans, the RWQCBs establish water quality objectives for surface water and groundwater resources and designate beneficial uses for each identified water body. The SWRCB has compiled a list of impaired water bodies in the state of California, called the 303(d) list. The list includes several hundred rivers, creeks, beaches, and wetland resources within the Bay Area. Each of these resources is listed with the specific pollutants or other stressors, such as flood control diversions, that contribute to the resources' deterioration. A priority schedule has

Figure 2.6-2
Major Rivers, Creeks and Other Water Bodies

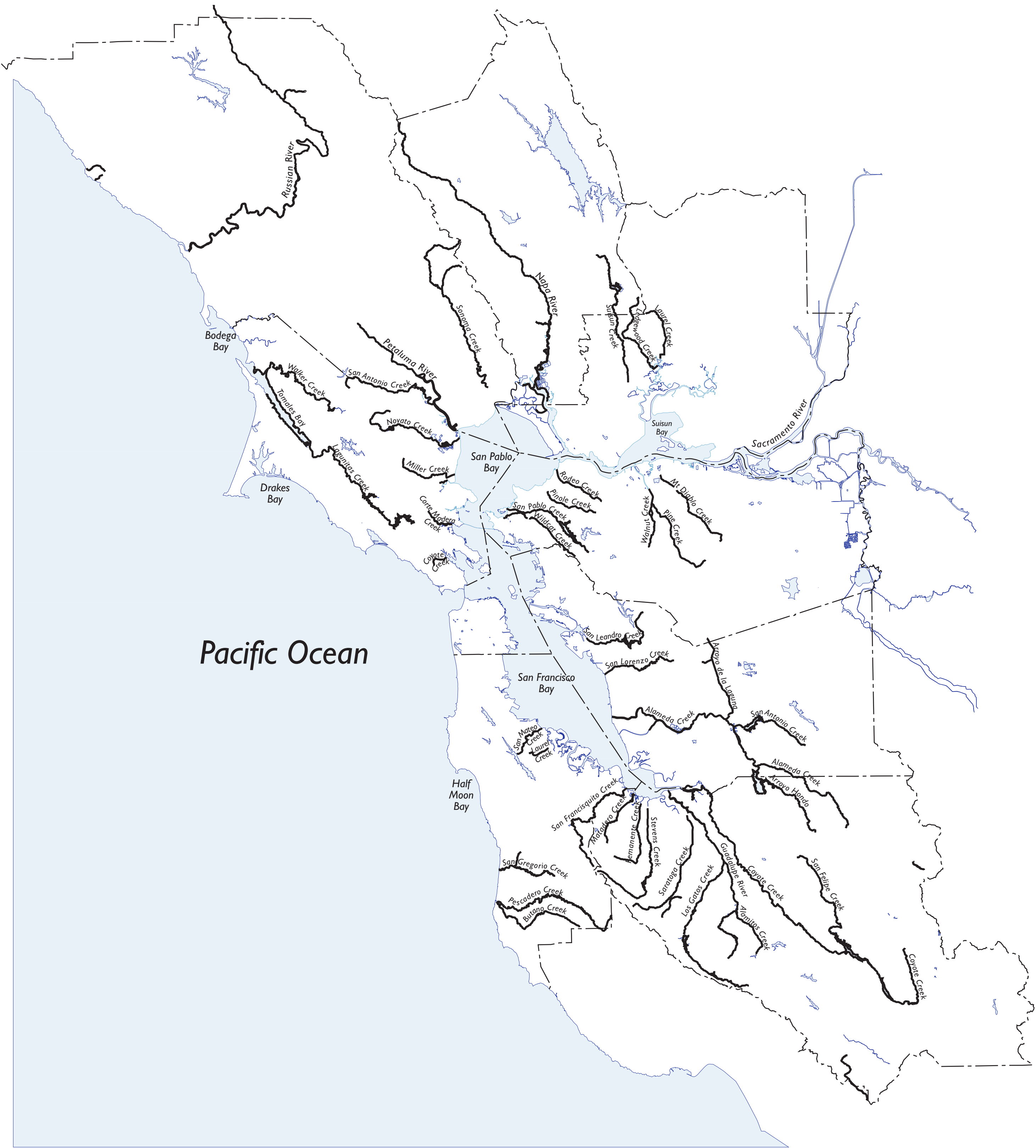
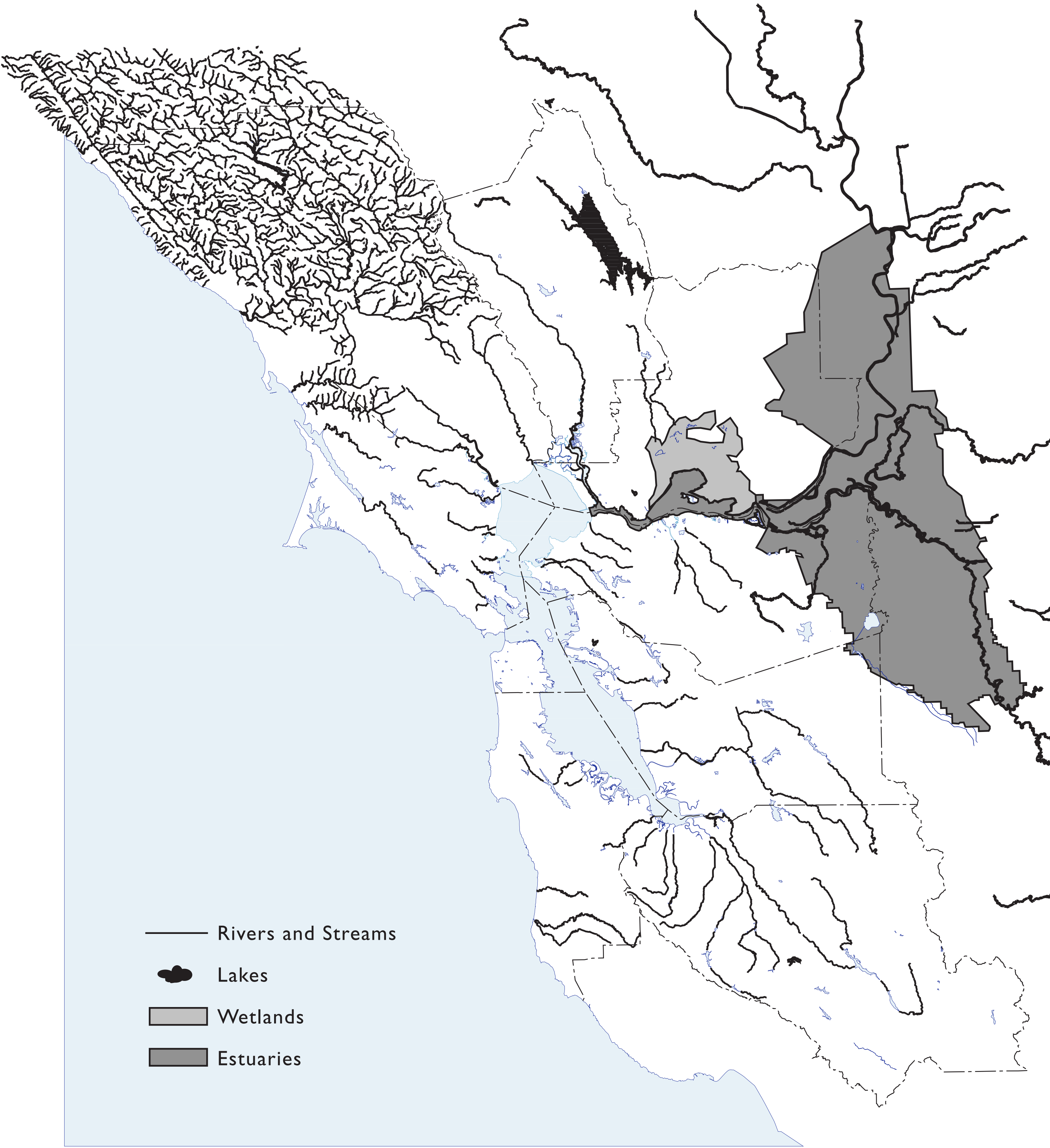


Figure 2.6-3
Impaired Water Bodies



been established to assign a TMDL for each pollutant listed in the region by 2012. The RWQCBs are responsible for developing strategies to attain compliance with the designated TMDLs.

California Water Code, Division 7, Chapter 5.6 established a comprehensive program within the SWRCB to protect the existing and future beneficial uses of California's enclosed bays and estuaries. The Bay Protection and Toxic Cleanup Program will also further compliance with federal law pertaining to the identification of waters where protection and propagation of shellfish, fish, and wildlife are threatened by toxic pollutants and contribute to the development of effective strategies to control these pollutants. In June 1999, the SWRCB published a list of known toxic hot spots in estuaries, bays, and coastal waters. Table 2.6-2 summarizes hot spots identified within the Bay Area.

Table 2.6-2: Known Toxic Hot Spots

		Reason for Listing	
Rank	*Site Identification*	*Definition Trigger*	*Pollutants*
High	Delta Estuary, Cache Creek watershed, including Clear Lake	Human health impacts	Mercury
High	Delta Estuary	Aquatic life impacts	Diazinon
High	San Francisco Bay, Castro Cove	Aquatic life impacts	Mercury, selenium, PAHs, dieldrin
High	San Francisco Bay, Entire Bay	Human health impacts	Mercury, PCBs, dieldrin, chlordane, DDT, dioxin Site listing was based on mercury and PCB health advisory.
High	San Francisco Bay, Islais Creek	Aquatic life impacts	PCBs, chlordane, dieldrin, endosulfan sulfate, PAHs, anthropogenically enriched H_2S and NH_3
High	San Francisco Bay, Mission Creek	Aquatic life impacts	Silver, chromium, copper, mercury, lead, zinc, chlordane, chlorpyrifos, dieldrin, mirex, PCBs, PAHs, anthropogenically enriched H_2S and NH_3
High	San Francisco Bay, Peyton Slough	Aquatic life impacts	Silver, cadmium, copper, selenium, zinc, PCBs, chlordane, ppDDE, pyrene
High	San Francisco Bay, Point Potrero/Richmond Harbor	Human health	Mercury, PCBs, copper, lead, zinc
High	San Francisco Bay, Stege Marsh	Aquatic life impacts	Arsenic, copper, mercury, selenium, zinc, chlordane, dieldrin, ppDDE, dacthal, endosulfan I, endosulfan sulfate, dichlorobenzophenone, heptachlor epoxide,

Table 2.6-2: Known Toxic Hot Spots

			Reason for Listing
Rank	*Site Identification*	*Definition Trigger*	*Pollutants*
			hexachlorobenzene, mirex, oxidiazon, toxaphene, PCBs
Moderate	San Francisco Bay Central Basin, San Francisco Bay	Aquatic life impacts	Mercury, PAHs
Moderate	San Francisco Bay, Fruitvale (area in front of storm drain)	Aquatic life impacts	Chlordane, PCBs
Moderate	San Francisco Bay, Oakland Estuary, Pacific Drydock #1 (area in front of storm drain)	Aquatic life impacts	Copper, lead, mercury, zinc, TBT, ppDDE, PCBs, PAHs, chlorpyrifos, chlordane, dieldrin, mirex
Moderate	San Francisco Bay, San Leandro Bay	Aquatic life impacts	Mercury, lead, selenium, zinc, PCBs, PAHs, DDT, pesticides

PCBs = polychlorinated biphenyls; PpDDE = a DDT derivative; PAHs = polycyclic aromatic hydrocarbons;
DDT = dichlorodiphenyltrichloroethane; TBT =tributyltin; H_2S = hydrogen sulfide; NH_3 = ammonia

Source: Environmental Science Associates, 2001.

Other statewide programs run by the SWRCB to monitor water quality include the California State Mussel Watch Program and the Toxic Substances Monitoring Program. The Department of Fish and Game collects water and sediment samples for the SWRCB for both these programs and provides extensive statewide water quality data reports annually. In addition, the RWQCBs conduct water sampling for water quality assessments required by the Clean Water Act and for specific priority areas under restoration programs such as the Sacramento–San Joaquin River and Northern San Francisco Bay Estuary Water Quality Surveillance, the Biennial Water Quality Inventory, and the San Joaquin River Subsurface Agricultural Drainage Monitoring Program. Detailed accounts of surface water monitoring programs are included in the regional Basin Plans.

STORMWATER/NONPOINT SOURCE

The 1987 Clean Water Act amendments required the EPA to establish regulations to control stormwater discharges associated with industrial activity and discharges from large and medium municipal storm sewer systems. Approximately two-thirds of California's water bodies assessed in the state's *Water Quality Assessment Report* (1992) are threatened or impaired by nonpoint sources of pollution. Much of this pollution is transported to surface waters by stormwater. The SWRCB requires communities with separate municipal storm sewer systems to obtain NPDES permits. Construction activities are covered under the statewide General Construction Stormwater Permit, requiring submittal of SWPPPs at least 30 days prior to ground disturbance.

WATERSHED MANAGEMENT

The Clean Water Action Plan, announced in 1998, requests that states and tribes, with assistance from federal agencies and input from stakeholders and private citizens, collaborate to develop

Unified Watershed Assessments. Under the Clean Water Action Plan, watersheds are to be placed in one of four categories:

- Category I – Watersheds that are candidates for increased restoration because of poor water quality or the poor status of natural resources.
- Category II – Watersheds that have good water quality but can still improve.
- Category III – Watersheds with sensitive areas on federal, state, or tribal lands that need protection.
- Category IV – Watersheds for which there is insufficient information to categorize them.

The Clean Water Action Plan identifies targeted watersheds and watershed priorities for each of California's nine RWQCBs. Clean Water Act funding administered by the SWRCB may be used to work on priority programs.

Watershed planning efforts have become prevalent as a means of protecting regional water resources through organizational approaches. Many regions in California have developed community-based authorities that bring together disparate stakeholders within a watershed. Stakeholder interests may include multiple municipalities, government entities, agricultural interests, industrial interests, private property owners with riparian rights, and environmental or conservation groups. These authorities can promote water quality protection and broker agreements between opposing interests to achieve a regional consensus outside of regulatory and legal environments.

WATER-RELATED HEALTH AND SAFETY HAZARDS

Flood Hazard

Portions of the Bay Area are subject to flooding. The U.S. Congress passed the National Flood Insurance Act in 1968 and the Flood Disaster Protection Act in 1973 to restrict certain types of development on floodplains and to provide for a national flood insurance program. The purpose of these acts is to reduce the need for large, publicly funded flood control structures and disaster relief.

The Federal Emergency Management Agency (FEMA) administers the National Flood Insurance Program. The program provides subsidized flood insurance to communities that comply with FEMA regulations to limit development in floodplains. FEMA issues Flood Insurance Rate Maps for communities participating in the National Flood Insurance Program. Figure 2.6-4 identifies federally designated flood hazard zones in the Bay Area.

FEMA classifies flood hazard zones as follows:

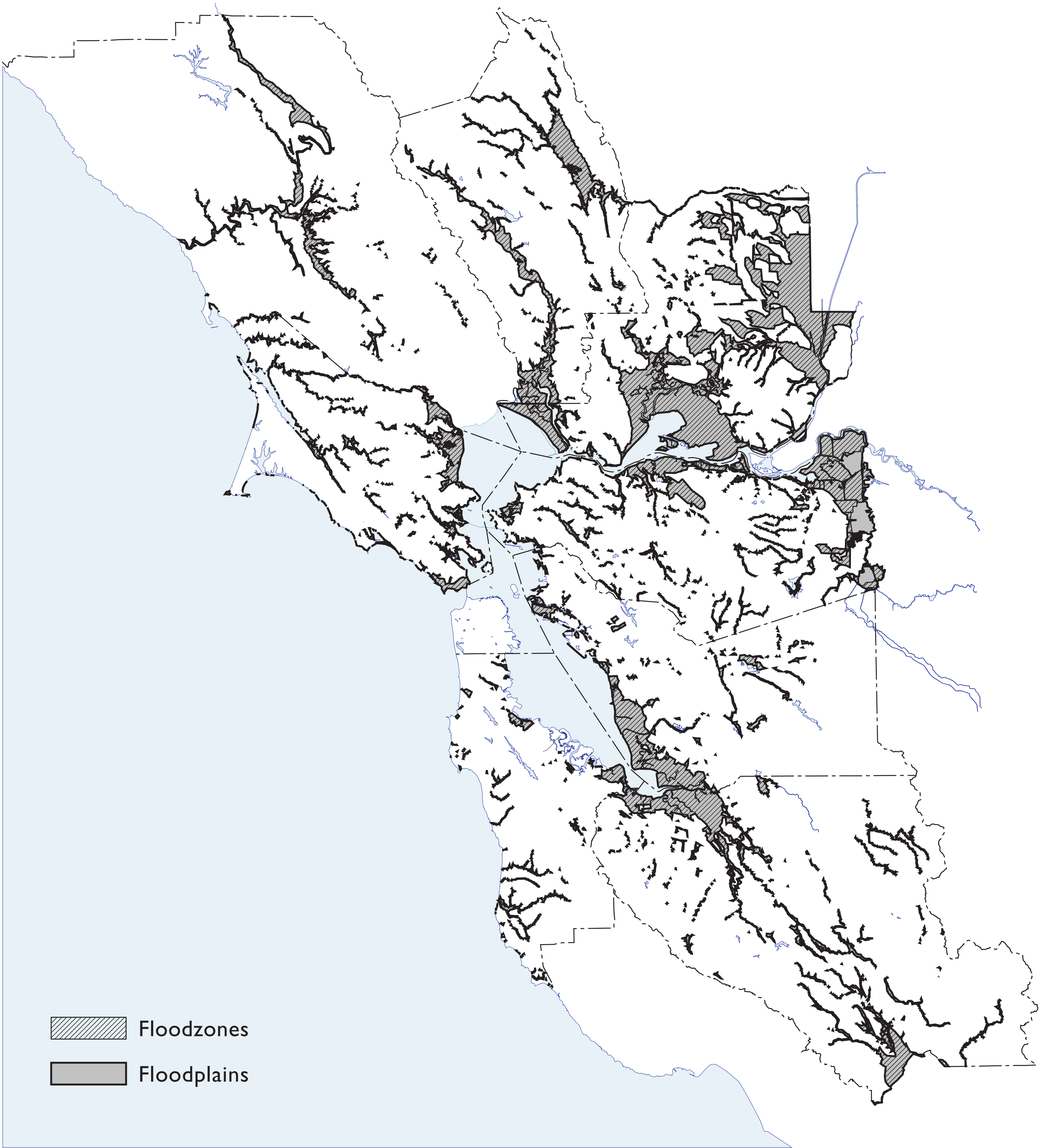
- *Zone A.* Flood insurance rate zone that corresponds to the 100-year floodplain, determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no base flood elevations or depths are shown within this zone. Mandatory flood insurance purchase requirements apply.

- *Zone B, C, and X.* Flood insurance rate zones that correspond to areas outside the limits of the 100-year floodplains; areas subject to 100-year sheet-flow flooding with average depth of less than 1 foot; areas of 100-year stream flooding where the contributing drainage area is less than one square mile; or areas protected from the 100-year flood by levees from the base flood. No base flood elevations or depths are shown within this zone.

- *Zone D.* Flood insurance rate zones that correspond to areas where there are possible but undetermined flood hazards. No analysis of flood hazards has been conducted. Mandatory flood insurance purchase requirements do not apply, but coverage is available. Flood insurance rates within Zone D are commensurate with the uncertainty of the flood hazard.

Many local jurisdictions regulate development within floodplains. Construction standards are established within local ordinances and planning elements to reduce flood impedance, safety risks, and property damage. Historic floods in the Bay Area have been devastating. In response, local flood control agencies and the U.S. Army Corps of Engineers have established extensive flood control projects, including dams and improved channels. Concrete and riprap levees and river bottoms have significantly reduced riparian habitats throughout the region.

Figure 2.6-4
Flood Hazard Areas



CRITERIA OF SIGNIFICANCE

This EIR uses the following criteria to assess whether proposed improvements in the 2001 RTP would have a significant adverse effect on water resources:

- **Criterion 1: Erosion from cut-and-fill slopes.** Implementation of the 2001 RTP would have a potentially significant impact if it results in erosion from cut-and-fill slopes that would contribute to sediment loads of stream and drainage facilities and affect water quality.

- **Criterion 2: Pollution of stormwater runoff from vehicle residues.** Implementation of the 2001 RTP would have a potentially significant impact if it results in major pollution of stormwater runoff due to litter, fallout from airborne particulate emissions, or discharges of vehicle residues, including petroleum hydrocarbons, oil, grease, and metals, that would impact the quality of receiving waters.

- **Criterion 3: Pollution of stormwater runoff from construction sites.** Implementation of the 2001 RTP would have a potentially significant impact if it results in pollution of stormwater runoff from construction sites due to discharges of sediment, chemicals, and wastes to nearby storm drains and creeks.

- **Criterion 4: Increased rates and amounts of runoff from impervious surfaces.** Implementation of the 2001 RTP would have a potentially significant impact if it results in increased rates and amounts of runoff due to additional impervious surfaces, higher runoff values for cut-and-fill slopes, or alterations to drainage systems, resulting in potential flood hazards and effects on water quality.

- **Criterion 5: Reduced rates of groundwater recharge.** Implementation of the 2001 RTP would have a potentially significant impact if it results in reduced rates of groundwater recharge due to the increased amount of impervious surfaces.

Potential effects on water resources would vary depending on the type and scale of the project, the location of the project relative to drainage facilities and water bodies, and the sensitivity of the receiving facility or water body.

METHOD OF ANALYSIS

Impacts to water resources were assessed using data compiled in GIS database format. The projects proposed in the 2001 RTP were plotted on maps of the Bay Area. Additional GIS water resources data compiled include surface hydrology, 100-year floodplains, impaired water bodies identified by the SWRCB, and the regional groundwater basins. Regulatory information and recommended mitigation measures were obtained from county hydrology manuals, statewide stormwater discharge permits, and state-recommended best management practices (BMPs) for stormwater management.

SUMMARY OF IMPACTS

Project-specific studies could be necessary to determine the actual potential for significant impacts on hydrology and water quality resulting from implementation of transportation improvements in the 2001 RTP. However, some general impacts can be identified based on the nature of the individual transportation improvements. As noted, projects located in targeted watersheds, adjacent to impaired water bodies, or in flood hazard areas are most likely to affect water resources. Because the 2001 RTP would increase the area of paved surface (roads, transit stations, park and ride lots, etc.) by a small amount (about 4 percent increase), construction of the proposed projects could cause water quality impacts. Water quality could be affected by stormwater runoff that passes over paved surfaces before it reaches a major creek, river, or water body.

Floodplains are areas that are periodically inundated during high flows of nearby streams or high water levels in ponds or lakes. Natural floodplains offer wildlife and plant habitat, open space, and groundwater recharge benefits. Project construction could affect these uses if not mitigated.

In areas where proposed transportation improvements are directly adjacent to or cross a drainage facility or water body, and in areas where projects are located in 100-year flood hazard areas, a proposed project would be likely to have a greater impact on water resources than projects further from drainage facilities, water bodies, or 100-year flood hazard areas.

DIRECT IMPACTS

Implementation of transportation improvements in the 2001 RTP could result in both short term and long term impacts on water resources.

Short Term Impacts

Short-term impacts are temporary and generally related to construction activities. Construction activities undertaken to implement transportation improvements in the 2001 RTP could include excavation, soil stockpiling, boring, and/or grading. Soil erosion is probable during construction and could directly affect the water quality of local drainage, which and could potentially be directed into the San Francisco Bay. Soils can contain nitrogen and phosphorus which, when carried into water bodies, can trigger algal blooms. Extensive blooms of algae can reduce water clarity, deplete oxygen concentrations, and create unpleasant odors. Excessive deposition of sediments in stream channels can blanket fauna and clog streambeds, degrading aquatic habitat. Increased turbidity from suspended sediments can also reduce photosynthesis that produces food supply and aquatic habitat. Additionally, sediment from project-induced on-site erosion could accumulate in downstream drainage facilities and interfere with stream flow, thereby aggravating downstream flooding conditions.

Depending on the transportation project location, impacts from construction could affect local storm drain catch basins, culverts, flood control channels, streams, and San Francisco Bay. Most runoff in urban areas is eventually directed to either a storm drain or water body, unless allowed to stand in a detention area and filter into the ground. For this reason, even projects not directly adjacent to or crossing a sensitive area could have an impact.

Bare slopes of construction sites can also be a major source of surface runoff pollution. Resulting water quality problems include sediment buildup and blockage of drainageways and channels, turbidity, increased algal growth and oxygen depletion.

Long Term Impacts

Increases in impervious surface area associated with paving, combined with increased overall regional traffic could increase the amount of nonpoint-source pollutants generated regionally. These nonpoint source pollutants include oil and grease, petroleum hydrocarbons, metals and possibly nutrients could occur. The paving required for highway projects could have minor effects on the amount of surface water that filters into the ground. Groundwater basins could be affected by pollutants in the runoff from proposed transportation facilities.

Many tributaries to and portions of San Francisco Bay and the Sacramento–San Joaquin Delta are listed as impaired water bodies on California's 303(d) list and could be adversely affected by pollutants and other stressors that affect water quality.

Table 2.6-3 identifies transportation improvements in the 2001 RTP that could result in a potentially significant impact on water resources based on their general proximity to impaired water bodies or flood hazard areas.

Table 2.6-3: 2001 RTP Projects with Potentially Significant Impacts on Water Resources

Corridor	*Project*	*Potential Impact*
Golden Gate	US 101/Tamalpais interchange improvements	Adjacent to North San Francisco Bay and in flood hazard area
	US 101/Lucas Valley Rd. interchange improvements	In flood hazard area
	Manzanita park and ride lot	In flood hazard area
	Widen US 101 between Old Redwood Hwy. and Rohnert Park Expwy.	In flood hazard area
	US 101 northbound and southbound HOV lanes between Marin County line and Old Redwood Highway	Adjacent to North San Francisco Bay and local creek and in flood hazard area
North Bay East-West	Widen Rte. 12 from 2 to 4 lanes between Solano County line and Rte. 29	Adjacent to creeks flowing into Suisun Marsh and San Francisco Bay
Napa Valley	Widen First Street overcrossing of Rte. 29 from 2 lanes to 4 lanes	Near the Napa River, an impaired water body
Eastshore-North	Ashby Ave./Shellmound interchange improvements	Adjacent to San Francisco Bay shoreline
	Gilman Ave. interchange improvements	Adjacent to San Francisco Bay shoreline
	Various improvements to local interchanges and arterials	Some improvements are adjacent to flood hazard area and impaired water body

Table 2.6-3: 2001 RTP Projects with Potentially Significant Impacts on Water Resources

Corridor	*Project*	*Potential Impact*
	Vallejo intermodal ferry station	Adjacent to Vallejo's waterfront on San Pablo Bay, an impaired water body
	Vallejo ferry maintenance facility	On Mare Island in the San Pablo Bay, an impaired water body, also in flood hazard area
	Widen I-80 from 6 to 8 lanes between Vacaville and Dixon	Portion of this segment flood hazard area
Delta	Widen Hillcrest Ave. ramp	Adjacent to Sacramento-San Joaquin Delta, an impaired water body
	Upgrade Rte. 4 to full freeway from I-80 to Cummings Skyway	Crosses over portion of Sacramento-San Joaquin Delta at Rodeo Creek, an impaired water body
	Widen Rte. 4 eastbound from 4 to 6 lanes between Somersville Rd. and Rte. 160	Adjacent to Sacramento-San Joaquin Delta, an impaired water body
Diablo	Caldecott Tunnel fourth bore	Adjacent to a small portion of flood hazard area
	Martinez intermodal terminal facility	Adjacent to San Francisco Bay shoreline
	Southbound HOV lane between Marina Vista interchange and N. Main St. and northbound between Rte. 242 and Marina Vista interchange	Adjacent to Sacramento-San Joaquin Bay Delta, an impaired water body
	Commerce Avenue extension between Pine Creek Rd. and Waterworld Pkwy.	Crosses over Pine Creek, an impaired water body
Tri-Valley	LAVTA satellite maintenance/operations facility	In flood hazard area
Eastshore-South	Rte. 260 interchange improvements	Adjacent to San Francisco Bay estuary
	Realign Langley St. and reconstruct Rte. 61 (Doolittle Dr.)	Adjacent to San Francisco Bay estuary
	BART-Oakland International Airport connector	Adjacent to San Francisco Bay estuary and tidelands
	Broadway Ave./Jackson St. interchange improvements	Adjacent to San Francisco Bay estuary
	Widen Thornton Ave. from 2 to 4 lanes between Gateway Blvd. and Hickory St.	In flood hazard area
	Central Ave. UPRR overpass	Adjacent to San Francisco Bay
	Widen Union City Blvd. from 4 to 6 lanes between Paseo Padre and Industrial Pkwy.	Crosses Alameda Creek, an impaired water body
	Hayward Bypass (Rte. 238) Harder Ave. to Industrial Pkwy. (Phases II and III)	Crosses Ward Creek, an impaired water body
Fremont–South Bay	BART to Warm Springs	Flood hazard area in vicinity of Lake Elizabeth
	Silicon Valley Rapid Transit Corridor	Adjacent to flood hazard area; crosses

Table 2.6-3: 2001 RTP Projects with Potentially Significant Impacts on Water Resources

Corridor	*Project*	*Potential Impact*
	Project (Project A)	Coyote Creek, an impaired water body
	Rail grade separations at Washington Blvd./Paseo Padre Pkwy. at Union Pacific Railroad in Fremont	Flood hazard area in vicinity of Lake Elizabeth
Silicon Valley	US 101/Fourth St./Zanker Rd. overcrossing and ramp modifications	Adjacent to flood hazard area and South San Francisco Bay, an impaired water body
	Rte. 237 westbound auxiliary lanes between Coyote Creek Br. and N. First St.	Adjacent to Coyote Creek, an impaired water body
	Widen Montague Expressway from 6 lanes to 8 lanes from I-680 to US 101	Crosses Coyote Creek and Guadalupe River, both impaired water bodies
	Widen US 101 from 6 lanes to 8 lanes from Metcalf Road to Cochrane Road	Crosses Coyote Creek, an impaired water body, and is adjacent to Parkway Lakes
	New Montague Expwy./Trimble Rd. flyover	In flood hazard area
	US 101/Trimble Rd./De La Cruz Blvd./Central Expwy. interchange improvements	Adjacent to Guadalupe River, an impaired water body, and in flood hazard area
	SR 87/US 101 ramp to Trimble Rd. interchange	Adjacent to Guadalupe River, an impaired water body, and in flood hazard area
Peninsula	US 101 northbound and southbound auxiliary lanes between Sierra Pt. Pkwy. and San Francisco County line	Adjacent to Bay and potential flood hazard area
	Various Caltrain system improvements	Portions of project are adjacent to flood hazard areas, portions of project cross creeks flowing to San Francisco Bay, some of which are impaired water bodies

Source: Environmental Science Associates, 2001

INDIRECT/CUMULATIVE IMPACTS

Implementation of transportation improvements in the 2001 RTP could result in indirect impacts on water resources by accommodating future planned urban development that could, when it occurs, have the potential to significantly impact water quality and alter drainage patterns. In addition, the combination of the transportation improvements in the 2001 RTP and new public and private infrastructure improvements serving future planned urban development could create higher erosion rates and reduced groundwater recharge.

SIGNIFICANT IMPACTS AND MITIGATION MEASURES

IMPACT

2.6-1 Construction of the proposed transportation improvements in the 2001 RTP could adversely affect water quality and drainage patterns in the short term due to erosion and sedimentation.

MITIGATION

MTC shall require that project sponsors comply with CEQA (and NEPA if appropriate) prior to project approval by MTC. Project sponsors shall commit to mitigation measures at the time of certification of their project environmental document. These commitments obligate project sponsors to implement measures that would minimize or eliminate any significant impacts on water resources. Local permitting agencies shall require preparation and implementation of a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP shall be consistent with the State Construction Storm Water General Permit, the *Manual of Standards for Erosion and Sedimentation Control* by the Association of Bay Area Governments, policies and recommendations of the local urban runoff program (city and/or county), and the recommendations of the RWQCB. Implementation of the SWPPP shall be enforced by inspecting agencies during the construction period via appropriate options such as citations, fines, and stop-work orders.

SIGNIFICANCE AFTER MITIGATION

These mitigation measures would be expected to reduce this potentially significant impact on water resources to a less-than-significant level if incorporated by project sponsors.

IMPACT

2.6-2 The transportation improvements in the 2001 RTP could adversely affect water resources in the long term by reducing permeable surfaces, which could result in additional runoff and erosion, and decreased drainage area and groundwater recharge.

MITIGATION

The MTC shall require that project sponsors comply with CEQA (and the National Environmental Policy Act, if appropriate) prior to approving the project. Project sponsors shall commit to mitigation measures at the time of certification or approval of project-related environmental documents. These commitments would obligate project sponsors to implement measures to minimize or eliminate any significant impacts on water resources. Typical mitigation measures that could be considered by project sponsors include:

Surface Water

- Drainage of roadway runoff should, wherever possible, be designed to run through grass median strips, contoured to provide adequate storage capacity and to provide overland flow, detention, and infiltration before it reaches culverts. Detention basins and ponds, aside from controlling runoff rates, can also remove particulate pollutants through settling.
- Proper erosion control measures should be implemented during construction, such as jute netting, straw mulches, chemical mulches, temporary retention ponds, or quick revegetation. Other control measures include limiting the amount of exposed area and preventing construction vehicles and/or equipment from passing through or near natural drainages.
- Long-term sediment control should include an erosion control and revegetation program designed to allow reestablishment of native vegetation on slopes in undeveloped areas.
- In areas where habitat for fish and other wildlife would be threatened by transportation facility discharge, alternate drainageways should be sought to protect sensitive fish and wildlife populations. Heavy-duty sweepers, with disposal of collected debris in sanitary landfills, should be used to effectively reduce annual pollutant loads. Catch basins and storm drains should be cleaned and maintained on a regular basis.

Groundwater

- Detention basins, infiltration strips, and other features to facilitate groundwater recharge should be incorporated into the design of new freeway and roadway facilities whenever possible.

Flooding

- Projects should be designed so that they do not increase downstream flooding risks by substantially increasing peak runoff volumes. This could be achieved by increasing the size of local flood control facilities serving the project areas, or by including detention ponds in designs for roadway medians, parking areas, or other facilities.
- Projects should be designed to allow lateral transmission of stormwater flows across transportation corridors with no increased risk of upstream flooding. Culverts and bridges should be designed to adequately carry drainage waters through project sites. The bottom of overpass structures should be elevated at least 1 foot above the 100-year flood elevation at all stream and drainage channel crossings.
- All roadbeds for new highway and rail transit facilities should be elevated at least 1 foot above the 100-year base flood elevation.

SIGNIFICANCE AFTER MITIGATION

Because the details of how each project will be designed and constructed, there is some potential that not all impacts can be mitigated to a less-than-significant level. However, given the relatively small amount of new paved surfaces the transportation improvements in the 2001 RTP would create, and considering available mitigation measures, it is unlikely there would be significant effects after mitigation.

CUMULATIVE IMPACT

2.6-3 Forecast urban development that would be served by transportation improvements in the 2001 RTP, combined with new public and private infrastructure improvements to accommodate future planned urban development, could create higher erosion rates and reduced groundwater recharge.

MITIGATION

As the cumulative impacts of the transportation improvements in the 2001 RTP are the same as the direct impacts listed above, the mitigation measures for this impact would also be the same.

SIGNIFICANCE AFTER MITIGATION

These mitigation measures would be expected to reduce this potentially significant cumulative impact on wildlife species to a less-than-significant level if incorporated by project sponsors.

2.7 Visual Resources

The San Francisco Bay Area contains some of the most recognizable natural and built views in the world. Important views of natural features include the Pacific coast, San Francisco Bay, Mount Tamalpais, Mount Diablo, and other peaks and inland valleys of the Coast Range. Enclosed views, such as along roads winding through redwood groves, and broader views of the ocean and lowlands, such as along ridgetops, are in abundance in the Bay Area. Cityscape views such as those offered by buildings and distinctive Bay Area bridges are also important built visual resources to the region. Transportation facilities have the potential to affect both what is seen and how it is seen.

This chapter describes the visual resources of the San Francisco Bay Area and the impacts that projects the 2001 RTP could have on those resources. This analysis will focus specifically on views from the road and transit corridors and on views of such facilities from surrounding areas.

SETTING

The landscapes of the San Francisco Bay Area are varied, unique, and recognized by many in the region and beyond. The basin formed by the coastal range, East Bay Hills, and the Bay itself are prominent physical features of the region. To the west the Pacific Ocean and the Coastal Range, stretching from Mt. Tamalpais in the north to the Santa Cruz Mountains in the south, dominate the visual setting. To the east the Diablo Range, dramatically punctuated by Mount Diablo, provides a much different character. In the north, the vineyards of Napa and Sonoma counties are unique and draw visitors from around the world. Many built features in the Bay Area, the Golden Gate and Bay Bridges and the San Francisco skyline in particular, are also of international renown. Bay Area residents and tourists alike treasure the variety and quality of the visual experiences that are found along many transportation corridors in the region, from heavily traveled freeways, transit lines, and ferries, to narrow country roads through secluded forests and agricultural areas. Major transportation projects may affect the visual experiences of travelers and the distinctive visual environment of the region.

The variety of natural features, their topographic variation and the different types of development within them provide the Bay Area with significant visual resources. The Bay Area sits along the Pacific coast with several branches of the Coast Range dividing it into valleys, plains and water bodies. The largest of these valleys contains San Francisco Bay while at the eastern edge of the region is the great Central Valley, an extremely flat plain lying between the Coast Range and the Sierra Nevada Mountains. The hills of the Coast Range provide expansive views of the valleys and plains below, revealing a variety of development types, including urban areas along the Bay plains and inland valleys, agricultural lands and protected open space, and natural areas.

HILLS AND VALLEYS

The region contains several distinct ranges and hills. Between the Pacific Ocean and San Francisco Bay lie the coastal hills of San Mateo, Santa Clara, and Marin Counties. The East Bay Hills rise steeply from the urbanized plain along the eastern edge of the Bay forming a several mile wide band that also defines the western edge of the Diablo and Livermore Valleys of Contra Costa and Alameda Counties. The rolling hills of the Diablo Range separate these valleys from the lowlands of the Central Valley. At the south end of the Bay Area in Santa Clara County, these hills converge. To the north, several ranges frame the Napa, Sonoma and Cotati valleys, which are famous for wine production.

Between these ranges and hills are numerous valleys, both broad and narrow. San Francisco Bay, for example, is bordered along the east and west by a narrow, heavily urbanized plain. This plain widens in the south into the Santa Clara Valley, which until World War II was primarily agricultural. The East Bay and coastal hills, which are visible throughout these lowlands, orient the traveler and give a sense of scale to the surrounding urban areas. Likewise to the north, the hills forming the Sonoma, Napa, and Cotati Valleys enclose these agricultural areas with urban pockets.

LANDMARKS AND GATEWAYS

Certain features of the Bay Area stand out as symbols and points of orientation. These landmarks include the Golden Gate and Bay Bridges, San Francisco skyline, several large buildings in the East Bay Hills (the Campanile on the U.C. Berkeley campus, the Claremont Hotel and the Mormon Temple in Oakland, for example), and Mount Saint Helena at the northern end of the Napa Valley. These landmarks help travelers to locate themselves within the region, and in the case of the Golden Gate Bridge, symbolize the Bay Area for the rest of the world.

Likewise, several points along the roadways and rail lines of the Bay Area serve as visual gateways to the region or parts of it. The rest area on I-80 above Vallejo, the west end of the Caldecott Tunnel, and "hospital curve" along Highway 101 in San Francisco offer dramatic views of what lies ahead for Bay Area travelers.

VIEWS FROM THE ROAD

Many roadways and rail lines provide expansive, regional views of surrounding areas, often due to their wide rights-of-way, location along high points, elevation of the facilities, or a combination of these factors. Examples include I-280 along the Peninsula, Highway 92 as it crosses the coastal range, I-80 near Rodeo, I-580 over the Altamont Pass and above Oakland, and the Route 24 corridor. The bridges crossing San Francisco Bay and the San Joaquin River offer similar experiences. Both the Bay and Golden Gate Bridge provide world-famous views of San Francisco while the Richmond-San Rafael Bridge includes sweeping views of the North Bay, including Mount Tamalpais and Angel Island. The Antioch Bridge allows views out over the Sacramento Delta.

Similarly, rail facilities (including BART) can provide travelers with similar broad views of the region or portions of it. The elevated BART lines through the East Bay, for example, give good views of the East Bay Hills and the neighborhoods of Oakland, Berkeley, El Cerrito, etc. The rail Amtrak lines along San Pablo Bay and the San Joaquin River also provide broad views of the water with the hills beyond.

Roads and rail lines also provide more intimate views of forested hills or narrow valleys. Highway 35 (along the crest of the San Mateo Peninsula) and Highway 84 (through the narrows of Niles Canyon) are examples of such views. Similarly, Highway 1 and Sir Francis Drake Boulevard run through the forests and grasslands of Marin County to the beaches, parks, and open space areas along the coast. Highway 29 and the Silverado Trail through the Napa Valley and Highway 12 through the Sonoma Valley provide dramatic views of enclosing hills, adjoining vineyards, and the wineries.

Finally, while carrying only a small portion of the region's travelers, the use of the Bay ferries can be attributed, in part, to the spectacular viewing experiences afforded by this mode of transport.

VIEWS OF THE ROAD

While roads and rail lines can provide access to view for travelers, these facilities can also detract from or block views for others, particularly those who live or work near such facilities. A new or expanded roadway along a hillside can be visible from a great distance, changing the impression of the hillside for the viewer, particularly if the hillside is undeveloped. Also, new roads and rail lines are often built above the level of existing development, which can overshadow nearby homes and businesses and limit views from them to the surrounding hills and valleys.

POLICY AND REGULATION

SCENIC ROADS

Recognizing the value of scenic areas and the value of views from roads in such areas, the State Legislature established the California Scenic Highway Program in 1963. This legislation sees scenic highways as "a vital part of the all encompassing effort…to protect and enhance California's beauty, amenity and quality of life." Under this program, a number of State highways have been designated as eligible for inclusion as scenic routes. Once the local jurisdictions through which the roadway passes have established a corridor protection program and the Departmental Transportation Advisory Committee recommends designation of the roadway, the State may officially designate roadways as scenic routes. Interstate highways, state highways, and county roads may be designated as scenic under the program. *The Master Plan of State Highways Eligible for Official Scenic Highway Designation* maps designated highway segments, as well as those that are eligible for designation. Changes to the map requires an act of the legislature.

As noted, a corridor protection program must be adopted by the local governments with land use jurisdiction through which the roadway passes as the first step in moving a road from "eligible" to "designated" status. Each designated corridor is monitored by the State and designation may be revoked if a local government fails to enforce the provisions of the corridor protection program. At a minimum, each corridor protection program must include:

- Regulation of land use and density of development;
- Detailed land and site planning;
- Control of outdoor advertising devices;

- Control of earthmoving and landscaping;
- Regulation of the design and appearance of structures and equipment.

The *Master Plan of State Highways Eligible for Official Scenic Highway Designation* requires that proposed realignments and route improvements be evaluated for their impact on the scenic qualities of the corridor.

The Bay Area includes several designated or eligible scenic highways included on the State Master Plan. Officially designated State Scenic Highways are illustrated in Figure 2.7-1 and include:

- Highway 1, from Half Moon Bay south to Santa Cruz County Line;
- Highway 9, from Los Gatos north to Santa Cruz County Line;
- Highway 12, through the Valley of the Moon;
- Highway 24, from the Caldecott Tunnel east to I-680;
- Highway 35, from Highway 92 south to Santa Clara County Line;
- Highway 116, from Highway 1 south to City of Sebastopol City Limit;
- I-280, from San Bruno (I-380) south to Santa Clara County Line;
- I-580, from Highway 24 south to San Leandro City Limit;
- I-680, from Highway 24 south to Santa Clara County Line.

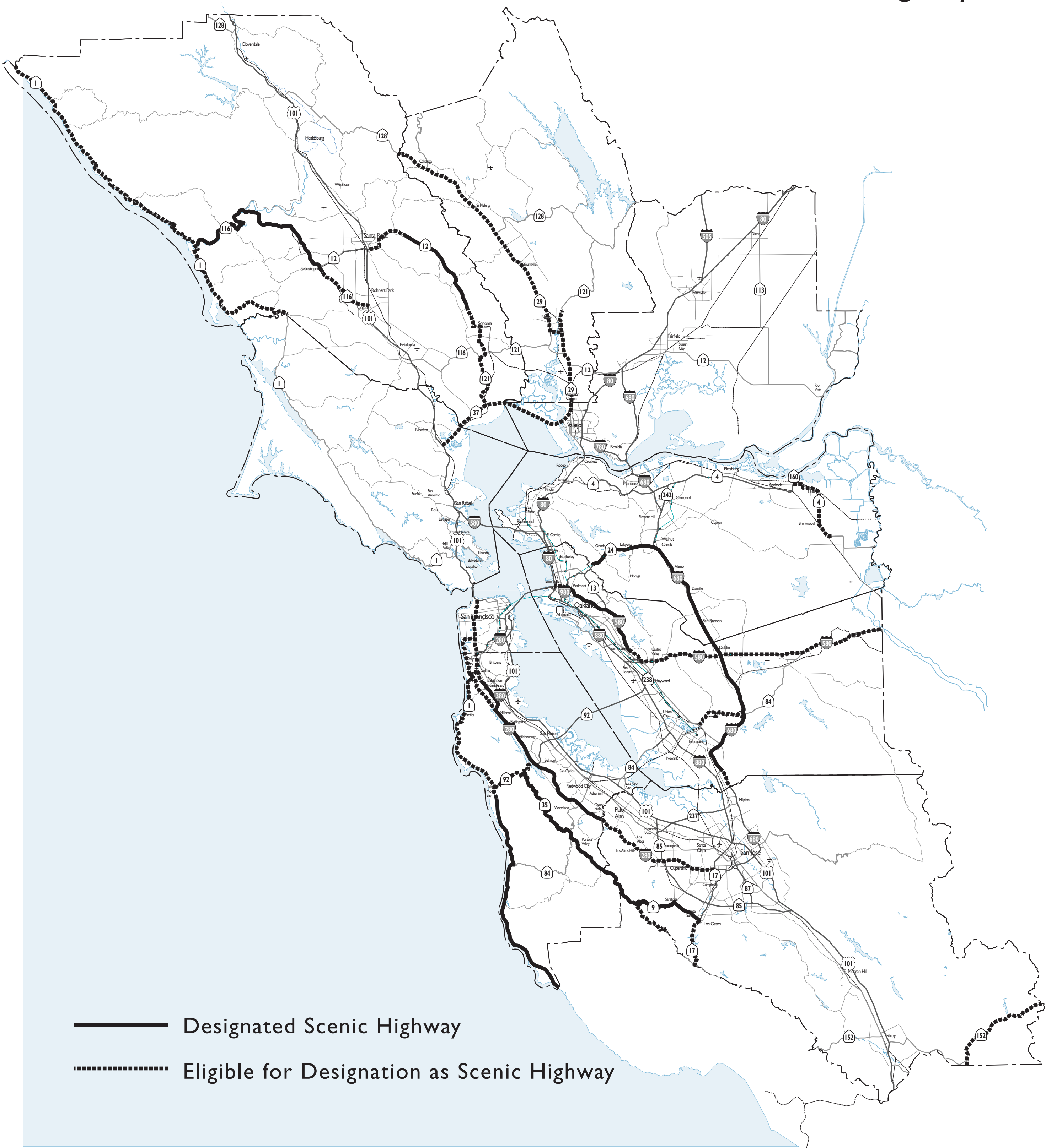
Highways mapped as eligible for scenic designation include:

- Highway 1, from Half Moon Bay north to Highway 35;
- Highway 1, from Highway 35 to Highway 101 near Golden Gate Bridge
- Highway 1, from Marin City north to Sonoma County Line;
- Highway 4, from Highway 160 south to Sellers Avenue;
- Highway 9, from Highway 85 south to Highway 17;
- Highway 29, from Highway 37 north to Highway 121;
- I-680, from Walnut Creek south to Alameda County Line.

Counties and municipalities also have scenic route components within their individual general plans. Policies usually encourage the designation of these roadways as scenic corridors, either by local action or through the State program, establish regulatory programs or recommend corridor studies to determine the appropriate regulatory program to preserve scenic quality.

Figure 2.7-1

Highway Segments Designated and Eligible for Designation as Scenic Highways



CRITERIA OF SIGNIFICANCE

This EIR will use the following criteria to assess whether the 2001 RTP will have a significant adverse effect on visual resources in the Bay Area:

- **Criterion 1: Blocks panoramic views or views of significant features.** Implementation of the 2001 RTP would have a potentially significant impact where constituent projects block panoramic views or views of significant landscape features or landforms (mountains, oceans, rivers, or significant man-made structures) as seen from the transportation facility or from the surrounding area.
- **Criterion 2: Alters the appearance of area near scenic highways.** Implementation of the 2001 RTP would have a potentially significant impact where constituent projects alter the appearance of or from state- or county-designated or eligible scenic highways. Such projects would be judged against a higher standard for visual impacts.
- **Criterion 3: Creates significant contrasts.** Implementation of the 2001 RTP would have a potentially significant impact where constituent projects create significant contrasts with the scale, form, line, color and/or overall visual character of the existing landscape setting.
- **Criterion 4: Adds an incongruous visual element.** Implementation of the 2001 RTP would have a potentially significant impact where constituent projects add a visual element of urban character to an existing rural or open space area or add a modern element to a historic area.

Generally, the greater the change from existing conditions, the more significant the impact. For example, the construction of a new interchange usually has a greater impact than the modification of an existing one. Likewise, the construction of a new roadway generally has a greater visual impact than the widening of an existing one. Road widenings, however, can have significant local impacts where they would require the removal of trees and other important landscape buffers or where they require the construction of sound walls or other contrasting visual elements.

METHOD OF ANALYSIS

The first step in the visual impact analysis involved the elimination of projects that would not involve construction or would not significantly change the configuration of existing transportation facilities, since such projects are unlikely to have a significant visual impact. Projects that involve construction but would not substantially modify existing facilities include seismic upgrades, safety improvements, signalization projects, freeway carpool lanes that do not require roadway widening, and roadway rehabilitation. Next, the remaining projects were reviewed to determine if they located on eligible or designated scenic highway segments or if they could significantly change the character of other important visual resources.

SUMMARY OF IMPACTS

Most of the transportation improvements in the 2001 RTP are not large enough to have a significant effect on the visual character of the surrounding area or on views from a facility itself. These projects include non-construction, minor rehabilitation, and some local arterial projects, many of which are not specifically identified and cannot be analyzed individually. However, other projects could significantly alter views from and views of transportation facilities in the Bay Area. These types of projects include freeway and roadway widenings, new freeway interchanges, and new rail lines (either light or heavy rail). Significant impacts would occur where the projects would block existing views or alter the appearance of a facility or the area that surrounds a facility.

DIRECT IMPACTS

Implementation of the transportation improvements in the 2001 RTP could result in both short term and long term visual impacts.

Short Term Impacts

The construction of proposed projects in the 2001 RTP could result in short-term visual impacts from the blockage of views by construction equipment and scaffolding, the removal of landscaping, temporary route changes, temporary signage, exposed excavation and slope faces, and construction staging areas. Typical mitigation measures used to minimize short term visual impacts include reducing the visibility of construction staging areas where possible and fencing and screening these areas with low contrast materials consistent with the surrounding environment. Graded slopes and exposed earth surfaces should be revegetated at the earliest opportunity. In any case, short term visual impacts are often unavoidable.

Long Term Impacts

Table 2.7-1 identifies proposed projects in the 2001 RTP that could result in a potentially significant visual impact. These projects include freeway widenings on scenic highway segments, some interchange projects, and BART extensions and stations. This table also indicates whether the projects identified are located on a state-designated scenic highway, or on a highway eligible for such designation. While there are no restrictions on scenic highway projects, local agencies and Caltrans must work together to coordinate projects and ensure the protection of the scenic value to the greatest extent possible.[1] In some cases, local governments have their own land use and site planning regulations in place to protect scenic values along a designated corridor. Both the impact of a facility on the landscape as well as the visual appearance of a facility itself are

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[1] State law requires the undergrounding of all visible electric distribution and communication utilities within 1,000 feet of a Scenic Highway.

considered.[2] On scenic highways, a pleasing appearance is as important a consideration as is safety, utility, and economy.

Table 2.7-1: 2001 RTP Projects with Potentially Significant Visual Impacts

Corridor/Subarea	*Project*	*Potential Impact*
Golden Gate	Widen US 101 from 4 to 6 lanes between Rte. 37 and Sonoma County line	This project would widen the freeway (primarily in the median) and could increase visual contrast with adjoining open space, hills, and Petaluma River plain.
	US 101 northbound and southbound HOV lanes between Marin County line and Old Redwood Highway	This project would widen the freeway (primarily in the median) and could increase visual contrast with adjoining rural lands and open space.
	US 101 northbound and southbound HOV lanes between Old Redwood Highway and Rohnert Park Expwy.	This project would widen the freeway (primarily in the median) and could increase visual contrast with adjoining rural lands and open space.
	US 101 northbound and southbound HOV lanes between Steele Ln. and Windsor River Rd.	This project would widen the freeway (primarily in the median) and could increase visual contrast with adjoining rural land.
North Bay East-West	Widen Rte. 12 from 2 to 4 lanes between I-80 and Rte. 29 (Jameson Canyon)	This project would widen the highway and could increase visual contrast with adjoining rangeland and rural land.
	New Rte. 221/Rte. 29 flyover	Located on a segment eligible for scenic designation, a new elevated structure would introduce a new visual element in the corridor and could block views from the roadway and adjoining areas of nearby hills and Napa River plain.
	Rte. 12/Rte. 29 grade separation	Located on a segment eligible for scenic designation, grade separation would could block views from the roadway of nearby hills and Napa River plain.
Eastshore-North	Eastbound and westbound HOV lanes between I-680 and I-505	This project would widen the freeway and could increase visual contrast with adjoining rural lands.
	Widen existing routes (Walters Road, Cement Hill Road, Vanden Road, Leisure Town Road) to create to establish 4 lane Jepson Pkwy. from Rte. 12 to I-80	This project would create a new parkway and could increase visual contrast with adjoining rural lands.
Delta	Upgrade to full freeway between I-80 (Sycamore Rd.) and Cummings Skyway	This project would establish a 2-lane freeway segment could increase visual contrast with adjoining open space and hills.
Eastshore-South	Hayward Bypass (Rte. 238) Harder Ave.	This project would create a new expressway

[2] Caltrans. *Guidelines for Official Designation of Scenic Highways.* November 1990, p. 14.

Table 2.7-1: 2001 RTP Projects with Potentially Significant Visual Impacts

Corridor/Subarea	*Project*	*Potential Impact*
	to Industrial Pkwy. (Phases II and III)	and could increase visual contrast with adjoining open space and hills.
Diablo	Auxiliary lane from Bollinger Canyon Rd. to Diablo Rd.	Located on a designated scenic segment, this project would widen the freeway within the existing right of way and could increase visual contrast with adjoining open space and hills. Limited soundwall construction could block views from the roadway and adjoining areas.
	Eastbound auxiliary lanes from Gateway Blvd. to Brookwood Rd./Moraga Wy.	Located on a designated scenic segment, this project would widen the freeway within the median and could increase visual contrast with adjoining open space.
Tri-Valley	New West Dublin-Pleasanton BART station	Located in the median on a segment eligible for scenic designation, this project would establish a pedestrian bridge over the highway which could block views from the roadway and adjoining areas.
Eastshore-South	BART-Oakland International Airport connector	Elevated structures would introduce a new visual element in the corridor and could block views from adjoining areas.
Fremont-South Bay	BART to Warm Springs	Elevated structures would introduce a new visual element in the corridor and could block views from adjoining areas.
	Silicon Valley Rapid Transit Corridor Project (Project A)	Elevated structures would introduce a new visual element in the corridor and could block views from adjoining areas.
Silicon Valley	New Montague Expwy./Trimble Rd. flyover	This project would establish an elevated structure thus introducing a new visual element in the corridor which could block views from the roadway and adjoining areas.
	New US 101/Buena Vista Ave. interchange with flyover	This project would establish an elevated structure thus introducing a new visual element in the corridor which could block views from the roadway and adjoining areas of nearby hills and rural lands.
	Rte. 25 upgrade to expressway from Bloomfield Ave. to San Benito County line	This project would widen the highway and could increase visual contrast with adjoining rural land.
Peninsula	US 101 northbound and southbound auxiliary lanes between Sierra Pt. Pkwy. and San Francisco County line	This project would widen the freeway and could increase visual contrast with adjoining open space and San Francisco Bay.

Source: Dyett & Bhatia, 2001.

In addition to the projects identified in Table 2.7-1, other projects may require the installation of soundwalls to mitigate noise impacts on adjacent residential development or other sensitive land uses. Soundwalls may have visual impacts for roadway users and adjacent communities.

INDIRECT/CUMULATIVE IMPACTS

Implementation of the transportation improvements in the 2001 RTP could result in indirect visual impacts by serving forecast urban development that could, when it occurs, significantly change the visual character of some areas adjacent to the region's existing urban limits, especially where new development would occur on visually prominent hillsides or in existing, visually open, rural lands. To the extent that the transportation improvements in the 2001 RTP, in aggregate, would serve new forecast urban development, they would add to cumulative regional impacts. In addition, other transportation improvements in the 2001 RTP not identified as having a direct visual impact in the regional context may result in individually minor visual impacts locally. Collectively, these individually minor visual impacts may become significant over time.

SIGNIFICANT IMPACTS AND MITIGATION MEASURES

IMPACT

2.7-1 **Construction of certain transportation improvements in the 2001 RTP could significantly affect visual resources by adding or expanding transportation facilities in rural or open space areas, blocking views from adjoining areas, blocking or intruding into important vistas along roadways, and changing the scale, character, and quality of designated or eligible Scenic Highways.**

MITIGATION

MTC shall require that project sponsors comply with CEQA (and NEPA if appropriate) prior to project approval by MTC. Project sponsors shall commit to mitigation measures at the time of certification of their project environmental document. These commitments obligate project sponsors to implement measures that would minimize or eliminate any significant visual impacts. Typical mitigation measures that could be considered by project sponsors include:

- Design projects to minimize contrasts in scale and massing between the project and surrounding natural forms and development. Site or design projects to minimize their intrusion into important view sheds.
- Use natural landscaping to minimize contrasts between the project and surrounding areas. Wherever possible, develop interchanges and transit lines at the grade of the surrounding land to limit view blockage. Contour the edges of major cut and fill slopes to provide a more natural looking finished profile.
- Design landscaping along highway corridors to add significant natural elements and visual interest to soften the hard edged, linear travel experience that would otherwise occur.

- Complete design studies for projects in designated or eligible Scenic Highway corridors. Consider the "complete" highway system and develop mitigation measures to minimize impacts on the quality of the views or visual experience that originally qualified the highway for Scenic designation.

SIGNIFICANCE AFTER MITIGATION

These mitigation measures would be expected to reduce potentially significant impacts on visual resources to a less-than-significant level if incorporated by project sponsors. It is not expected that these mitigation measures would eliminate all visual impacts, and the implementation of some transportation improvements in the 2001 RTP may result in visual changes that could be considered adverse and significant by some viewers.

IMPACT

2.7-2 **The construction of soundwalls along freeways and arterials, where they are used to reduce noise levels in surrounding residential areas, could significantly alter views from the road reducing visual interest and sense of place while also limiting views and sunlight from adjoining areas.**

MITIGATION

Transportation project sponsors should consider the following mitigation measures to minimize significant visual impacts:

- Replace and renew landscaping to the greatest extent possible along corridors with road widenings, interchange projects and related improvements. Plan landscaping in new corridors to respect existing natural and man-made features and to complement the dominant landscaping of surrounding areas.
- Where possible, develop new or expanded roadways below the grade of surrounding areas to minimize the need for tall soundwalls.
- Construct soundwalls of materials whose color and texture complements the surrounding landscape and development.
- Where there is room, landscape the soundwalls with plants that screen the soundwall, preferably with either native vegetation or landscaping that complements the dominant landscaping of surrounding areas.

SIGNIFICANCE AFTER MITIGATION

These mitigation measures are not expected to reduce this potentially significant impact on visual resources to a less-than-significant level in all cases. As such, this impact would likely remain significant, depending upon the extent, design, and specific location of the soundwalls.

CUMULATIVE IMPACT

2.7-3 Forecast urban development that would be served by transportation improvements in the 2001 RTP could significantly change the visual character of many areas in the region, especially where development would occur on visually prominent hillsides or in existing rural or open space lands.

MITIGATION

Local land use agencies are responsible for the approval of forecast urban development. These agencies should apply development standards and guidelines to maintain compatibility with surrounding natural areas, including site coverage, building height and massing, building materials and color, landscaping, site grading, etc., in visually sensitive sites areas.

SIGNIFICANCE AFTER MITIGATION

This mitigation measure is not expected to reduce this potentially significant cumulative impact on visual resources to a less-than-significant level, since the cumulative effect of forecast development would be to alter the visual character of many parts of the Bay Area over the next 25 years.

2.8 Noise

In most of the Bay Area, transportation—motor vehicles, transit systems, railroads, aircraft and boats—is the primary source of environmental noise. Automobile and truck traffic is the most prevalent noise source throughout the region's urban communities. Noise can have real effects on human health, including hearing loss and the psychological effects or irritability from lack of sleep. This chapter outlines how noise is described, measured, and regulated. It also describes the sources of transportation noise in the Bay Area and evaluates the potential effect of transportation improvements in the 2001 RTP on noise levels within the region.

SETTING

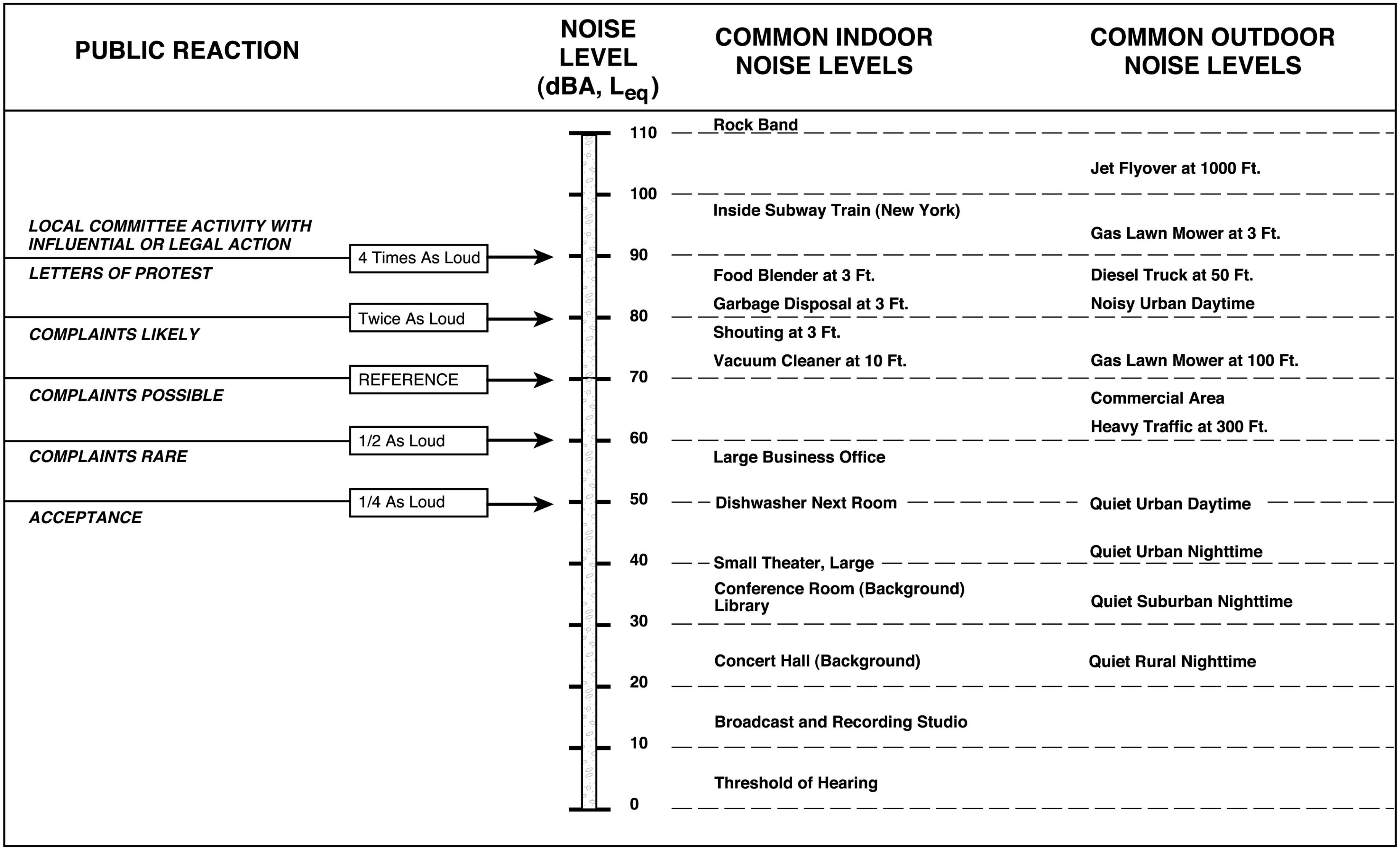
NOISE DESCRIPTORS

Sound waves, traveling outward from a source, exert a sound pressure level (commonly called "sound level"), measured in decibels (dB). In general, people can perceive a two- to three-dB difference in noise levels; a difference of 10 dB is perceived as a doubling of loudness. "Noise" is often defined as unwanted sound. Environmental noise is usually measured in *A-weighted* decibels; a metric corrected for the variation in frequency response of the human ear. The A-weighted scale is used to describe all noise levels discussed in this section.

Environmental noise levels typically fluctuate over time; different types of noise descriptors are used to account for this variability. Some descriptors characterize cumulative noise over a given period, while others describe single noise events. Cumulative noise descriptors include the energy-equivalent noise level (L_{eq}), Day-Night Average Noise Level (DNL), and Community Noise Equivalent Level (CNEL). The L_{eq} is the actual time-averaged, equivalent steady-state sound level, which, in a stated period, contains the same acoustic energy as the time-varying sound level during the same period. Some representative noise sources and their corresponding A-weighted noise levels are shown in Figure 2.8-1.

DNL and CNEL values result from the averaging of L_{eq} values (based on A-weighted decibels) over a 24-hour period, with weighting factors applied to different periods of the day to account for their greater relative annoyance. For DNL, noise that occurs during the nighttime period (10:00 p.m. to 7:00 a.m.) is penalized by 10 dB. The CNEL descriptor is similar to DNL, except that it also includes a penalty of approximately 5 dB for noise that occurs during the evening period (7:00 p.m. to 10:00 p.m.). Cumulative noise descriptors, DNL and CNEL, are well correlated with the likelihood of public annoyance from transportation noise sources.

Individual noise events, such as train passbys, are further described using single-event and cumulative noise descriptors. For single events, the maximum measured noise level (L_{max}) is often cited, as is the Sound Exposure Level (SEL). The SEL is the energy-based sum of a given-duration noise event squeezed into a reference duration of one second.



Source: Caltrans Transportation Laboratory Noise Manual, 1982; and Modification by Environmental Science Associates, 2001.

Figure 2.8-1
Noise Effects on People

SOUND PROPAGATION AND ATTENUATION

Sound level naturally decreases as one moves further away from the source. This basic attenuation rate is referred to as the *geometric spreading loss*. The basic rate of geometric spreading loss depends on whether a given noise source can be characterized as a point source or a line source. For a point source, such as an idling truck or jackhammer, the noise level decreases by about 6.0 dB for each doubling of distance away from the source.

In many cases, noise attenuation from a point source increases by 1.5 dB from 6.0 dB to 7.5 dB for each doubling of distance due to ground absorption and reflective wave canceling. These factors are collectively referred to as *excess ground attenuation*. The basic geometric spreading loss rate is used where the ground surface between a noise source and a receiver is reflective, such as parking lots or a smooth body of water. The excess ground attenuation rate (7.5 dB per doubling of distance) is used where the ground surface is absorptive, such as soft dirt, grass, or scattered bushes and trees.

For a line source, such as a heavily traveled roadway, the noise level decreases by a nominal value of 3.0 dB for each doubling of distance between the source and the receiver. If the ground surface between source and receiver is absorptive rather than reflective, the nominal rate increases by 1.5 dB to 4.5 dB for each doubling of distance. Atmospheric effects, such as wind and temperature gradients, can also influence noise attenuation rates from both line and point sources of noise. However, unlike ground attenuation, atmospheric effects are constantly changing and difficult to predict.

Trees and vegetation, buildings, and barriers reduce the noise level that would otherwise occur at a given receptor distance. However, for a vegetative strip to have a noticeable effect on noise levels, it must be dense and wide. For example, a stand of trees must be at least 100 feet wide and dense enough to completely obstruct a visual path to the roadway to attenuate traffic noise by 5 dB.[1] A row of structures can shield more distant receivers depending upon the size and spacing of the intervening structures and site geometry. Generally, for an at-grade highway in an average residential area where the first row of houses cover at least 40 percent of the total area, the reduction provided by the first row of houses is approximately 3 dB, and 1.5 dB for each additional row.[2] Similar to vegetative strips discussed above, noise barriers, which include natural topography and soundwalls, reduce noise by blocking the line of sight between the source and receiver. Generally, a noise barrier that breaks the line of sight between source and receiver will provide at least a 5-dB reduction in noise.

EFFECTS OF NOISE

Human reaction to noise ranges from annoyance, to interference with various activities, to hearing loss and stress-related health problems. These effects of noise are discussed below:

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[1] California Department of Transportation (Caltrans), *Technical Noise Supplement, A Technical Supplement to the Traffic Noise Analysis Protocol*, October 1998.
[2] Ibid.

- ***Potential hearing loss*** is commonly associated with occupational exposures in heavy industry or very noisy work environments. Noise levels in neighborhoods, even near very noisy airports, are not sufficiently loud to cause hearing loss.
- ***Speech interference*** is one of the primary concerns associated with environmental noise. Normal conversational speech is in the range of 60 to 65 dB and any noise in this range or louder may interfere with speech. Depending upon the distance between the talker and the listener, background noise levels may require a raised voice in order to communicate. Transportation sources can easily interfere with conversation within a few hundred feet of the source.
- ***Sleep interference*** is a major noise concern related to traffic-generated noise. Sleep disturbance studies have identified interior noise levels attributed to traffic noise as a key factor of sleep disturbance. However, it should be noted that sleep disturbance does not necessarily mean awakening from sleep, but can refer to altering the pattern and stages of sleep. Train noise (especially horn soundings) is a major source of complaints.
- ***Physiological responses*** are those measurable noise effects on the human metabolism. They are ascertained as changes in pulse rate, blood pressure, etc. While such effects can be induced and observed, the extent to which these physiological responses cause harm or are a sign of harm is not known.
- ***Annoyance*** is the most difficult of all noise responses to describe. Annoyance is a very individual characteristic and can vary widely from person to person. What one person considers tolerable can be quite unbearable to another of equal hearing capability. (For instance, some people like the sound of trains, while others do not.)

SENSITIVE RECEPTORS

People in residences, motels and hotels, schools, libraries, churches, hospitals, nursing homes, auditoriums, natural areas, parks and outdoor recreation areas are generally more sensitive to noise than are people at commercial and industrial establishments. Consequently, the noise standards for sensitive land uses are more stringent than for those at less sensitive uses. Sensitive receptors of all types are located within the 2001 RTP travel corridors.

To protect various human activities in sensitive areas (e.g., residences, schools, and hospitals), lower noise levels are generally required. For example, a maximum outdoor noise level of 55 to 60 DNL is necessary for intelligible speech communication inside a typical home. Social surveys and case studies have shown that complaints and community annoyance in residential areas begin to occur when outdoor noise reaches 55 DNL.[3] Sporadic complaints associated with the 55 to 60 DNL range give rise to widespread complaints and sometimes individual threats of legal action within the 60 to 70 DNL range. At 70 DNL and above, residential community reaction typically involves threats of legal action and strong appeals to local officials to stop the noise.

[3] U.S. Environmental Protection Agency, *Noise Effects Handbook,* July 1981.

EXISTING NOISE SOURCES

Principal Bay Area noise sources are airports, freeways, arterial roadways, port facilities, and railroads. Additional noise generators include industrial manufacturing plants and construction sites. Local collector streets are not considered to be a significant source of noise since traffic volume and speed are generally much lower than for freeways and arterial roadways.

Airports

The Bay Area airport system consists of a total of 47 airport facilities, which include 4 commercial service airports, 22 general aviation airports, 3 military airports, 2 special use airports and 16 private use airports. Airport operation, particularly the large commercial service airports play a significant role in the noise environment of many Bay Area communities. Bay Area airport system development is addressed regionally in the *Regional Airport System Plan* (RASP) and locally in individual airport master plans. The airport master plans address community noise issues near airports.

Freeways and Arterial Roadways

Vehicle traffic background noise levels vary throughout the day based on the average density of noise sources in a given area. Traffic noise at a particular location depends upon the traffic volume on the roadway, the average vehicle speed, distance between the receptor and the roadway, the presence of intervening barriers between source and receiver, and the ratio of trucks (particularly heavy trucks) and buses to automobiles.

A number of factors control how traffic noise levels affect nearby sensitive land uses. These include roadway elevation compared to grade; structures or terrain intervening between the roadway and the sensitive receptors; and the distance between the roadway and receptors. For example, measurements show that depressing a freeway by approximately 12 feet yields a reduction in traffic noise relative to an at-grade freeway of 7 to 10 dB at all distances from the freeway.[4] Traffic noise from an elevated freeway is typically 2 to 10 dB lower than an equivalent at-grade facility within 300 feet of the freeway. However, beyond 300 feet, the noise radiated by an elevated and at-grade freeway (assuming equal traffic volumes, truck mix, and vehicle speed) is the same.[5] Caltrans or other sponsors of freeway projects conduct detailed noise studies for their environmental documents when these projects are ready for implementation.

The Bay Area has an enormous number of arterial roadways. Typical arterial roadways have one or two lanes of traffic in each direction, with some containing as many as four lanes in each direction. Noise from these sources can be a significant environmental concern where buffers (e.g., buildings, landscaping, etc.) are inadequate or where the distance from centerline to sensitive uses is relatively small. Given typical daily traffic volumes of 10,000 to 40,000, noise levels along arterial roadways typically range from DNL 65 to 70 dB at a distance of 50 feet from the roadway centerlines. In some cases, traffic noise is so pervasive that it can depress property

[4] Beranek, Leo L., *Noise and Vibration Control*, 1988.
[5] Ibid.

values for residential uses. Project sponsors for new or widened arterials conduct detailed noise analyses for these projects as part of their environmental documents when these projects are ready for implementation.

Railroad Operations

The two basic types of railroad operations are freight trains, and passenger rail operations, the latter consisting of commuter and intercity passenger trains and steel-wheel urban rail transit. Generally, freight operations occur at all hours of the day and night while passenger rail operations are concentrated within the daytime and evening periods.

Trains can generate high, relatively brief, intermittent noise events. Train noise is an environmental concern for sensitive uses located along rail lines and in the vicinities of switching yards. Locomotive engines and the interaction of steel wheels and rails generate primary rail noise. The latter source creates three types of noise: 1) rolling noise due to continuous rolling contact; 2) impact noise when a wheel encounters a rail joint, turnout or crossover; and 3) squeal generated by friction on tight curves. For very high-speed rail vehicles, air turbulence can be a significant source of noise.[6]

Train air horns and crossing bell gates contribute to loud noise levels near grade crossings. Table 2.8-1 provides reference noise levels in terms of Sound Exposure Levels (SEL) for different types of rail operations.

Table 2.8-1: Reference Noise Levels for Various Rail Operations

Source/Type		*Reference Conditions*	*Reference Noise Level (SEL)*[1]
Commuter Rail, At-Grade	Locomotives	Diesel-Electric, 3,000 horsepower, throttle 5	92
		Electric	90
	Cars	Ballast, welded rail	82
Rail Transit		At-grade, ballast, welded rail	82
Automated Guideway Transit	Steel wheel	Aerial, concrete, welded rail	80
	Rubber tire	Aerial, concrete guideway	78
Monorail		Aerial straddle beam	82
Maglev		Aerial, open guideway	72

[1] Measured at 50 feet from track centerline with trains operating at 50 miles per hour. For the sake of comparison, an automobile passby event generates an SEL of approximately 73 dB, and a city bus generates an SEL of approximately 84 dB.

Source: U.S. Department of Transportation, Federal Transit Administration, Transit Noise and Vibration Impact Assessment, *April 1995.*

Freight Trains

Freight trains are a source of environmental noise at many locations in the Bay Area. Freight train noise consists of locomotive engine sound and rail car wheel-rail interaction. In addition to noise, freight trains also generate substantial ground-borne noise and vibration near the tracks. Ground-

[6] U.S. Department of Transportation, Federal Transit Administration, *Transit Noise and Vibration Impact Assessment*, April 1995.

borne noise and vibration is a function of quality of the track and the operating speed of the vehicles. (Improvements to private railroad rights of way are not part of the RTP).

Commuter and Intercity Passenger Trains

In the Bay Area, there are four commuter and intercity passenger train operators: Caltrain, Capitol Corridor, ACE, and AMTRAK. Passenger trains can be powered by diesel or electric locomotives, with the electric motors being comparatively quiet. Noise from local and regional passenger trains is primarily from diesel engines and train whistles.

Heavy and Light Rail Transit

Heavy rail is generally defined as electrified rapid transit trains with dedicated guideway, and light rail as electrified transit trains that do not require dedicated guideway. In general, noise increases with speed and train length, and is most problematic within 50 feet of the track. BART trains, operating at- or above-grade, typically generate noise levels of about 70 DNL at a distance of 100 feet from the tracks. The DNL drops to about 60 dBA at a distance of 400 feet. Light rail noise levels vary, depending upon vehicle speed, number of cars per train, and whether the trains operate on embedded or tie-and-ballast trackway. The distance to the 60 DNL contour for light rail is typically 100 to 150 feet from the tracks.

Construction Noise Sources

Construction can be another significant, although typically short-term, source of noise. Construction is most significant when it takes place near sensitive land uses, occurs at night, or in early morning hours. As discussed above, local governments typically regulate noise associated with construction equipment and activities through enforcement of noise ordinance standards, implementation of general plan policies, and imposition of conditions of approval for building or grading permits. Table 2.8-2 shows typical exterior noise levels at various phases of commercial construction, and Table 2.8-3 shows typical noise levels associated with various types of construction related machinery.

Table 2.8-2: Typical Construction Phase Noise Levels

Construction Phase	*Noise Level (dBA, Leq)*[1]
Ground Clearing	84
Excavation	89
Foundations	78
Erection	85
Finishing	89

[1] Average noise levels 50 feet from the noisiest source and 200 feet from the rest of the equipment associated with a given construction phase. Noise levels correspond to commercial projects in a typical urban ambient noise environment.

Source: Bolt, Beranek and Newman, U.S. EPA, Noise From Construction Equipment and Operations, Building Equipment, and Home Appliances, *1971.*

Table 2.8-3: Typical Noise Levels from Construction Equipment

	Noise Levels (dBA at 50 feet)	
Construction Equipment	*Without Noise Control*	*With Feasible Noise Control*[1]
Earthmoving		
Front Loaders	79	75
Backhoes	85	75
Dozers	80	75
Tractors	80	75
Scrapers	88	80
Graders	85	75
Trucks	91	75
Pavers	89	80
Materials Handling		
Concrete Mixers	85	75
Concrete Pumps	82	75
Cranes	83	75
Derricks	88	75
Stationary		
Pumps	76	75
Generators	78	75
Compressors	81	75
Impact		
Pile Driver	101	95
Jack Hammers	88	75
Rock Drills	98	80
Pneumatic Tools	86	80
Other:		
Saws	78	75
Vibrators	76	75

[1] Feasible noise controls represent estimates obtained by using quieter procedures or equipment and noise control features that would require no major design or extreme cost. Quieted equipment can be designed with enclosures, mufflers, or noise-reduction features.

Source: Bolt, Beranek and Newman, U.S. EPA, Noise From Construction Equipment and Operations, Building Equipment, and Home Appliances, *1971.*

The dominant construction equipment noise source is usually a diesel engine, without sufficient muffling. In a few cases however, such as impact pile driving or pavement breaking, process noise dominates. Stationary equipment operates in one location for one or more days at a time, with either a fixed-power operation (pumps, generators, compressors) or a variable noise operation (pile drivers, pavement breakers). Mobile equipment moves around the construction site with power applied in cyclic fashion (bulldozers, loaders), or to and from the site (trucks). Construction-related noise levels generally fluctuate depending on the construction phase, equipment type and duration of use, distance between noise source and receptor, and presence or absence of barriers between noise source and receptor.

POLICY AND REGULATION

Federal, state and local agencies regulate different aspects of environmental noise. Generally, the federal government sets noise standards for transportation-related noise sources closely linked to interstate commerce. These include aircraft, locomotives, and trucks. The state government sets noise standards for those transportation noise sources such as automobiles, light trucks, and motorcycles. Noise sources associated with industrial, commercial, and construction activities are generally subject to local control through noise ordinances and general plan policies. Local general plans identify general principles intended to guide and influence development plans, and noise ordinances set forth the specific standards and procedures for addressing particular noise sources and activities.

Federal Regulations

Federal regulations for railroad noise are contained in 40 CFR, Part 201 and 49 CFR, Part 210. Noise limits are implemented through regulatory controls on locomotive manufacturers. For locomotives manufactured during or after 1980, noise limits are as follows:

- Stationary locomotives (at idle throttle setting) are not to exceed 70 dB at 15 meters (approximately 50 feet) from the track pathway centerline;
- Stationary locomotives (at all other throttle settings) are not to exceed 87 dB at 15 meters;
- Moving locomotives are not to exceed 90 dB at 15 meters.

Sounding locomotive horns or whistles in advance of highway-rail grade crossings has been used as a safety precaution by railroads since the late 1880s. The manner in which horns have been sounded (two longs, one short and one long) was standardized in 1938. In response to a growing national trend towards restrictions on the use of locomotive horns under local ordinances and a related increase in collisions, Congress passed the Swift Rail Development Act, which directed the Federal Railroad Administration to develop rules addressing this issue. In January 2000, the Federal Railroad Administration published a proposed rule that would require use of locomotive horns or whistles when approaching public road/rail grade crossings, except in approved quiet zones, where supplementary safety measures have been installed or adopted by the state or locality. The proposed rule would also establish an upper limit (104 or 111 dB) for the loudness of train horns.[7]

The Federal truck passby noise standard is 80 dB at 15 meters from the vehicle pathway centerline (trucks more than 4.5 tons, gross vehicle weight rating, under 40 CFR, Part 205, Subpart B). This standard is implemented through regulatory controls on truck manufacturers. Under regulations established by the Federal Highway Administration, noise abatement must be considered for federal or federally-funded projects involving the construction of a new highway or significant modification of an existing freeway. Abatement is considered when the project would result in a substantial noise increase or when the predicted noise levels approach or exceed the Noise

[7] Federal Railroad Administration, *Federal Register*, January 13, 2000.

Abatement Criteria (23 CFR Part 772). Under this criteria, a *substantial increase* is defined as a 12 dB increase in the L_{eq} during the traffic peak hour. The Noise Abatement Criteria differ among various activity categories and between exterior spaces and interior spaces. For sensitive uses, such as residences, schools, churches, parks, and playgrounds, the Noise Abatement Criteria for interior and exterior spaces during the traffic peak hour is 57 and 67 L_{eq}, respectively.

State Regulations

The State of California establishes noise limits for vehicles licensed to operate on public roads. For heavy trucks, the passby standard is consistent with the federal limit of 80 dB. The State passby standard for light trucks and passenger cars (less than 4.5 tons, gross vehicle rating) is also 80 dB at 15 meters from the centerline.[8] These controls are implemented through controls on vehicle manufacturers and by legal sanction of vehicle operators by state and local law enforcement officials. Caltrans uses FHWA Noise Abatement Criteria to evaluate noise impacts.

The State of California has also established noise insulation standards for new multi-family residential units, hotels, and motels that would be subject to relatively high levels of transportation-related noise. These requirements are collectively known as the California Noise Insulation Standards and are found in *California Code of Regulations*, Title 24. These standards set forth an interior standard of 45 DNL in any habitable room. It requires an acoustical analysis demonstrating building design to meet this interior standard where the project site is subject to noise levels greater than 60 DNL. Title 24 standards are typically enforced by local jurisdictions through the building permit process.

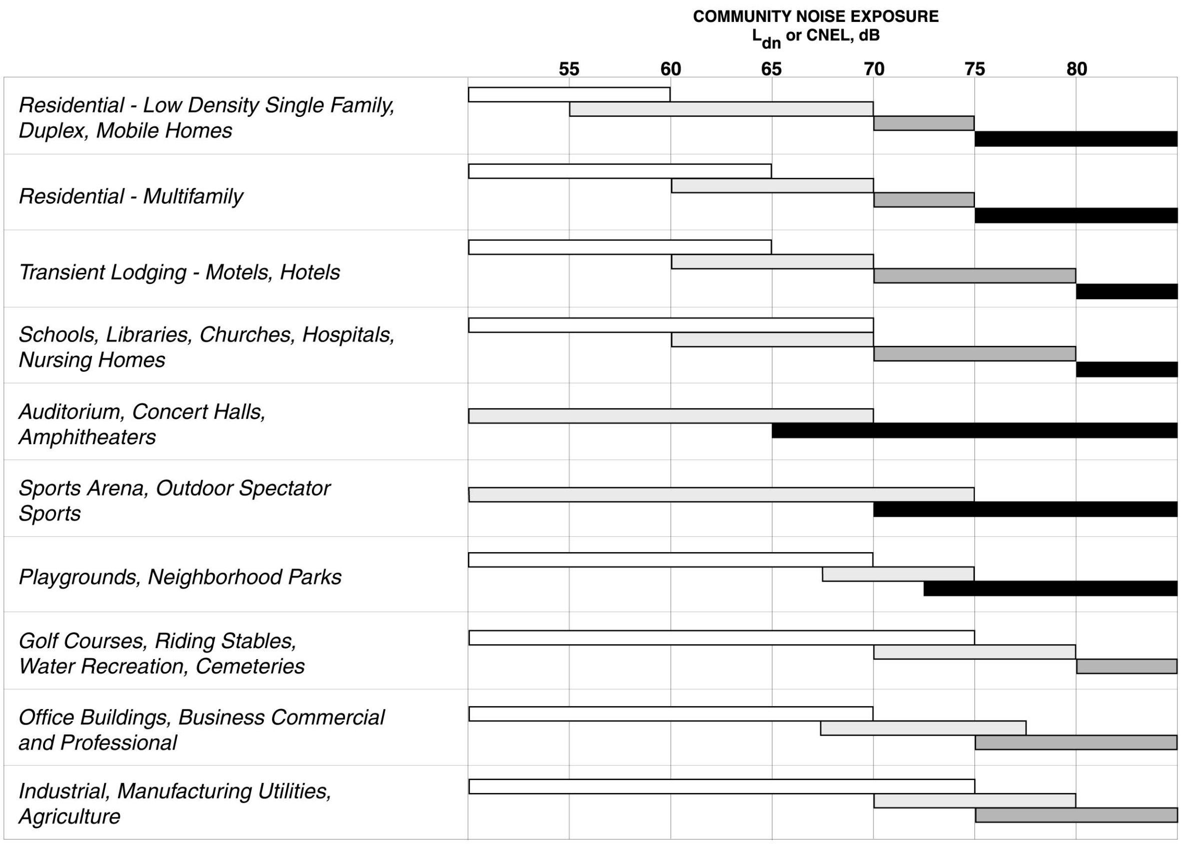
Local Regulations

To identify, appraise, and remedy noise problems in the local community, each county and city in the Bay Area is required to adopt a Noise Element as part of its General Plan. Each Noise Element is required to analyze and quantify, to the extent practicable, current and projected noise levels associated with local noise sources. These include, but are not limited to, highways and freeways, primary arterials and major local streets, rail operations, air traffic, local industrial plants, and other stationary sources that contribute to the community noise environment.

Beyond statutory requirements, local jurisdictions are free to adopt their own goals and policies in their Noise Elements. However, most jurisdictions have chosen to adopt noise/land use compatibility policies derived from State recommendations. For instance, most jurisdictions have adopted noise/land use compatibility guidelines that are similar to those recommended by the State (see Figure 2.8-2).

For residential uses, outdoor noise levels of less than 60 DNL or less are considered "normally acceptable"; outdoor noise levels between 60 and 70 DNL are "conditionally acceptable"; and outdoor noise levels exceeding 70 DNL are "normally unacceptable." Under State guidelines, new schools, libraries, churches, hospitals, and nursing homes that are proposed in areas subject to

[8] California Vehicle Code, §23130 and 23130.5; 27150, *et seq.*; 27204 and 27206.



LEGEND:

NORMALLY ACCEPTABLE
Specified land use is satisfactory, based upon the assumption that any building involved is of normal conventional construction, without any special noise insulation requirements.

CONDITIONALLY ACCEPTABLE
New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.

NORMALLY UNACCEPTABLE
New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

CLEARLY UNACCEPTABLE
New construction or development should generally not be undertaken.

Source: Environmental Science Associates, 2001.

Figure 2.8-2
Noise and Land Use Compatibility Matrix Guidelines

DNL 60 to 70 dB should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. For many land uses, the State recommendations show overlapping DNL ranges for two or more compatibility categories. These overlapping DNL ranges indicate that local conditions (existing noise levels and community attitudes toward dominant noise sources) should be considered in evaluating land use compatibility at specific locations.

In addition to regulating noise through implementation of noise element policies, local jurisdictions regulate noise through enforcement of local ordinance standards. These standards generally relate to noisy activities (e.g., use of loudspeakers and construction) and stationary noise sources and facilities (e.g., air conditioning units and industrial activities). Generally, federal and state laws preempt local agencies from establishing noise standards for transportation-related noise sources, such as aircraft, ships, trains, and motor vehicles.

CRITERIA OF SIGNIFICANCE

This EIR uses the following criteria to assess whether the proposed transportation improvements in the 2001 RTP will have a significant adverse effect on the community noise environment:

- **Criterion 1: Highways.** Implementation of the 2001 RTP would have a potentially significant impact if it results in noise levels that approach or exceed the FHWA Noise Abatement Criteria or increase substantially above existing levels (a 3 dB change would be considered noticeable).
- **Criterion 2: Rail Transit.** Implementation of the 2001 RTP would have a potentially significant impact if it results in noise levels that increase by more than the allowable noise exposure permitted under the Federal Transit Administration (FTA) criteria, as shown in Table 2.8-4, below.

Table 2.8-4 Noise Impact Criteria: Effect on Cumulative Noise Exposure

Ldn or Leq in dBA (rounded to nearest whole decibel)			
Existing Noise Exposure	*Allowable Project Noise Exposure*	*Allowable Combined Total Noise Exposure*	*Allowable Noise Exposure Increase*
45	51	52	7
50	53	55	5
55	55	58	3
60	57	62	2
65	60	66	1
70	64	71	1
75	65	75	0

Source: Office of Planning, Federal Transit Administration, Transit Noise and Vibration Impact Assessment. *Final Report, April 1995.*

METHOD OF ANALYSIS

Since noise is a highly localized impact, specific and detailed analyses are most appropriate at the project level. Therefore, the method to assess noise impacts of the 2001 RTP is to review the list of proposed transportation improvements and assess the likelihood of potentially significant noise impacts based on the type of project, location, and general land uses surrounding the project. A doubling of traffic on a road is generally required to increase noise levels by a perceptible level, which is 3 dBA. Subsequent project-specific EIRs will be required to further analyze these proposed improvements to determine the magnitude of noise and vibration impacts, and to identify appropriate potential mitigations for each individual project.

Table 2.8-5: Growth in Vehicle Trips by RTP Corridor (1998 to 2025, millions of trips per day)

	1998	*2025-No Project*	*2025-Project*	*2025*
Corridor Description	*Vehicle Trips*	*Vehicle Trips*	*Vehicle Trips*	*Percent change*
Unassigned to Primary Corridors	18,626	31,493	31,048	67
Unassigned to Secondary Corridors	11,706,547	15,089,856	15,069,247	29
Golden Gate: Intra Marin+Sonoma	1,265,622	1,663,202	1,656,462	31
Golden Gate: Marin+Sonoma <-> SF	100,309	118,717	116,666	16
Golden Gate: Marin+Sonoma <-> SM, SC	23,636	34,206	33,807	43
North Bay East-West	50,708	89,322	89,172	76
Transbay - Richmond/San Rafael	41,625	74,397	73,682	77
San Francisco: Intra San Francisco	672,946	693,533	693,076	3
Transbay – San Francisco/Oakland	307,250	406,007	405,029	32
Peninsula: Intra-San Mateo	1,132,178	1,345,662	1,345,394	19
Peninsula: SF <-> SM, SC	474,461	559,850	555,267	17
Peninsula: SM <-> SC	335,651	436,635	436,234	30
Transbay: Dumbarton / San Mateo-Hayward	147,948	217,071	216,663	46
Silicon Valley: Intra-Santa Clara	3,574,693	4,496,084	4,495,057	26
Silicon Valley: Inter-Santa Clara	702,201	972,206	961,818	37
Fremont/South Bay: East Bay <-> South Bay	178,261	245,572	241,227	35
Fremont/South Bay: Intra-Santa Clara	465,300	597,816	597,575	28
Eastshore-South: Intra-Alameda	1,284,245	1,490,377	1,487,839	16
Eastshore-South: I-80 Corridor	272,191	332,825	331,344	22
Eastshore-South: Solano	18,105	29,690	29,470	63
Sunol Gateway	111,588	203,552	202,363	81
Tri-Valley	336,693	579,155	577,635	72
Diablo: Alameda-Solano	923,662	1,221,763	1,220,483	32
Diablo: Contra Costa - I-80 (Ala/CC)	62,692	83,182	83,271	33
Diablo: Contra Costa - I-880	22,963	39,533	39,410	72
Diablo: East City Council <-> Solano	9,630	19,677	19,615	104
Delta	337,430	597,589	597,725	77
Eastshore-North	928,429	1,291,659	1,290,857	39
Napa Valley: Intra-Napa County	201,932	277,341	277,772	38
Napa Valley: Inter-Napa County	40,574	81,788	82,071	102
Bay Area Total	***12,874,048***	***16,659,878***	***16,628,640***	***29***

Source: Metropolitan Transportation Commission, 2001.

While the criterion for determining potentially adverse impacts apply to specific projects in the proposed 2001 RTP, the background projections for traffic growth in individual corridors are shown above in Table 2.8-5. The shaded rows would grow in traffic by 50 percent or more under MTC projections.

SUMMARY OF IMPACTS

DIRECT IMPACTS

Implementation of transportation improvements in the 2001 RTP could result in both short- and long-term impacts on noise levels in the MTC area. In addition, area wide growth in traffic could result in cumulative noise impacts in some locations, depending on the local setting.

Short Term Impacts

Many of the transportation improvements in the 2001 RTP entail construction, often using heavy equipment. Such activity would generate localized, short term noise impacts from excavation, grading, hauling, concrete pumping, and a variety of other activities requiring the operation of heavy equipment.

Long Term Impacts

A number of transportation improvements in the 2001 RTP have been identified as having potentially significant local noise impacts, either from vehicle or rail travel. Direct impacts could result from new transit lines (noise and ground borne vibration), widening of freeways which brings noise closer to sensitive land uses, or addition of new lanes that result in higher traffic volumes and speeds. Project-level analysis may or may not find significant noise impacts depending upon the project and the existing or projected land use.

Table 2.8-6 lists individual transportation improvements in 2001 RTP that have the potential to create a significant noise impact since they could trigger significance criterion 1 or 2, as defined above, related to either highway or rail. Noise mitigation for these new projects may reduce noise in communities that would otherwise continue to experience adverse noise impacts from existing and future traffic had not the RTP improvements occurred.

Table 2.8-6: 2001 RTP Projects With Potential Noise Impacts

Corridor	*Project*
Golden Gate	Widen US 101 from 4 to 6 lanes between Rte. 37 and Sonoma County line
	US 101 northbound and southbound HOV lanes between Rohnert Park Expwy. and Wilfred Ave.
	US 101 northbound and southbound HOV lanes between Old Redwood Highway and Rohnert Park Expwy.
	North Coast Railroad Authority track maintenance and rehabilitation
	Various US 101 interchange improvements

Table 2.8-6: 2001 RTP Projects With Potential Noise Impacts

North Bay East-West	Rte. 29/12/121 intersection improvements
	Rte. 12/29/221 intersection improvements
	Rte. 12/29 grade separation
	Widen Rte. 12 from 2 to 4 lanes between I-80 and Rte. 29 (Jameson Canyon)
Napa Valley	Widen First St. overcrossing of Rte. 29 from 2 lanes to 4 lanes
Eastshore-North	Extend Mandela Pkwy. from Horton St. to Hollis St.
	Extend I-80 westbound HOV from Cummings Skyway to Route 4
	Widen I-80 from 6 lanes to 8 lanes between Vacaville and Dixon
	New Amtrak Capitol rail stations with potential sites in Fairfield/Vacaville, Dixon, and Benicia
	Widen existing routes (Walters Rd., Cement Hill Rd., Vanden Rd., Leisure Town Rd.) to create 4 lane Jepson Pkwy. from Rte. 12 to I-80
	Eastbound and westbound HOV lanes between I-680 and I-505
	Various local arterials improvements
Delta	Upgrade Rte. 4 to full freeway from I-80 to Cummings Skyway
	Widen Rte. 4 from 4 lanes to 8 lanes from Loveridge Rd. to Somersville Rd. with HOV lanes
	Widen Rte. 4 eastbound from 4 to 6 lanes between Somersville Rd. and Rte. 160
	Rte. 4/Rte. 160 freeway-to-freeway connectors
	Widen Hillcrest Ave. ramp
Diablo	I-680/Rte. 4 freeway-to-freeway connectors
	Auxiliary lane from Bollinger Canyon Rd. to Diablo Rd.
	Southbound HOV lane between Marina Vista interchange and N. Main St. and northbound between Rte. 242 and Marina Vista interchange
	I-80/I-680/Rte. 12 interchange improvements
	Various arterial extensions/widenings (Alhambra Ave., Pacheco Blvd., Commerce Ave., etc.)
Tri-Valley	Eastbound and westbound HOV lanes between Tassajara Rd. and Vasco Rd.
	I-580/Isabel Avenue (Rte. 84) interchange improvements
	Widen Dublin Boulevard from Village Pkwy. to Sierra Ct.
Eastshore-South	42nd Ave./High St. access improvements to I-880
	Rte. 260/I-880 connector improvements
	Realign Langley St. and reconstruct Rte. 61 (Doolittle Dr.)
	Widen Marina Blvd. between Alvarado Blvd. and San Leandro Blvd.
	Widen Thornton Ave. from 2 to 4 lanes between Gateway Blvd. to Hickory St.
	Tinker Ave. extension from Main St. to Webster St.
	Widen Rte. 262/Warren Ave./I-880 interchange and East Warren Ave./UPRR grade separation

Table 2.8-6: 2001 RTP Projects With Potential Noise Impacts

	Widen Union City Blvd. from 4 to 6 lanes from Paseo Padre Ave. to Industrial Pkwy.
	BART-Oakland International Airport connector
	Westbound I-580/Rte. 238 (Hayward Bypass) connector
	Hayward Bypass (Rte. 238) Harder Ave. to Industrial Pkwy. (Phases II and III)
	I-880/Broadway-Jackson interchange improvements
Fremont-South Bay	BART to Warm Springs
	Rte. 84 southbound HOV extension from Newark Blvd. to I-880
	Rte. 84 southbound HOV onramp from Newark Blvd. to existing Rte. 84 southbound HOV lane
	Rail grade separations at Washington Blvd. and Paseo Padre Pkwy.
	Silicon Valley Rapid Transit Corridor Project (Project A)
Silicon Valley	New US 101/Buena Vista Ave. interchange with flyover
	I-880/Coleman Ave. interchange improvements
	US 101/Fourth St./Zanker Rd. overcrossing and ramp modifications
	I-280/I-680 connector to southbound US 101
	Rte. 85 northbound to I-280 northbound and I-280 exit to Foothill Expwy. ramps
	Montague Expwy./San Tomas Expwy./US 101/Mission College Blvd. interchange improvements
	Route 25/Santa Teresa Blvd./US 101 interchange construction
	Widen Rte. 237 for HOV lanes between Rte. 85 and US 101
	Rte. 25 upgrade to expressway from Bloomfield Ave. to San Benito County line
	Widen Rte. 85 between I-280 and Fremont Ave.
	I-880/Stevens Creek Blvd. Interchange improvements
	US 101/Tennant Ave. interchange improvements
	US 101/Trimble Rd./De La Cruz Blvd./Central Expwy. interchange improvements
	US 101/Tully Rd. interchange modifications
	US 101 auxiliary lane from Route 87 to Montague Expwy.
	Rte. 87/US 101 ramp connection to Trimble Rd. interchange
	Construct Butterfield Blvd. from San Pedro Rd. to Watsonville Rd.
	Extend Mary Ave. from Almador Ave. to H. St., including Rte. 237/US 101 overcrossing
	Widen US 101 from 6 lanes to 8 lanes from Metcalf Road to Cochrane Road
	Route 85/US 101 HOV direct connectors
	Caltrain extension to Salinas/Monterey
	San Jose-Santa Clara fourth main track and station upgrades
	Extend Vasona light rail transit from Winchester to Vasona Junction

Table 2.8-6: 2001 RTP Projects With Potential Noise Impacts

	Widen Montague Expwy. from 6 lanes to 8 lanes from I-680 to US 101
	Widen Central Expwy. from 6 lanes to 8 lanes between Rte. 237 and De La Cruz Ave.
	New Montague Expwy./Trimble Rd. flyover
Peninsula	Various US 101 interchange improvements
	Widen Rte. 84 from 4 lanes to 6 lanes between El Camino Real and Broadway
	US 101 northbound and southbound auxiliary lanes between Sierra Pt. Pkwy. and San Francisco County line
	US 101 northbound and southbound auxiliary lanes between Marsh Rd. and Santa Clara County line
	US 101 northbound and southbound auxiliary lanes between San Bruno Ave. and Grand Ave.
	Westbound passing lane on Rte. 92 between US 101 and I-280
	US 101 northbound and southbound auxiliary lanes between Third Avenue and Millbrae/Peninsula Interchange.
Transbay	Dumbarton rail bridge rehabilitation

Source: Environmental Science Associates, 2001

INDIRECT/CUMULATIVE IMPACTS

The growth in traffic throughout the Bay Area could produce unquantifiable cumulative noise impacts that would increase noise but may not reach thresholds for perceptible increases as defined above.

SIGNIFICANT IMPACTS AND MITIGATION MEASURES

IMPACT

2.8-1 Construction of the transportation improvements proposed in the 2001 RTP would have short-term noise impacts on surrounding areas.

MITIGATION MEASURES

MTC shall require that project sponsors comply with CEQA (and NEPA if appropriate) prior to project approval by MTC. Project sponsors shall commit to mitigation measures at the time of certification of each environmental document and at the time of project approval. Construction noise mitigation normally required by Caltrans, as well as local city and county ordinances. Construction mitigation measures generally limit construction activities to times when construction noise would have the least effect on adjacent land uses, and would require such measures as properly muffling equipment noise, and turning off equipment when not in use.

SIGNIFICANCE AFTER MITIGATION

These mitigation measures would be expected to reduce potentially significant construction-related noise impacts to a less-than-significant level if incorporated by project sponsors. It is not expected that these mitigation measures would eliminate all construction-related noise impacts since complete mitigation may not be possible for certain projects, such as those that require pile driving.

IMPACT

2.8-2 Transportation improvements proposed as part of the 2001 RTP could result in noise levels that approach or exceed the FHWA and FTA Noise Abatement Criteria.

MITIGATION MEASURES

MTC shall require that project sponsors comply with CEQA (and NEPA if appropriate) prior to project approval by MTC. Project sponsors shall commit to mitigation measures at the time of certification of their environmental document. Noise mitigation measures must respond to local land use compatibility criteria, and, if federal funding is used for the project, mitigation measures must also conform to applicable FHWA or FTA noise abatement criteria. These commitments obligate project sponsors to implement measures that would minimize or eliminate any significant impacts. Typical mitigation measures that should be considered by project sponsors include:

- Construction of sound walls adjacent to new or improved roads or transit lines. Noise level increases could, in most cases, be mitigated to levels at or below existing levels if sound walls were constructed along the rights-of-way. A determination of the specific heights, lengths, and feasibility of sound walls must be part of the project-level environmental assessment. Caltrans will evaluate the feasibility of sound walls based on the height required to attenuate noise, the number of people protected, and the cost of the sound wall. It is likely that FHWA noise abatement criteria would be met if sound walls are included as mitigation measures along the identified projects. Where the 2001 RTP would improve existing roadways, sound walls would also result in a reduction of overall sound levels, even considering potential increases from road widenings and additional traffic. As a result, the implementation of this mitigation measure can avoid project noise impacts *and* reduce existing noise levels along a number of heavily-traveled corridors in the region.
- Adjustments to proposed roadway or transit alignments to reduce noise levels in noise sensitive areas. For example, depressed roadway alignments can effectively reduce noise levels in nearby areas.
- Insulation of buildings or construction of noise barriers around sensitive receptor properties.
- Vibration isolation of track segments.
- Use of local land use policies by local agencies to guide the location of noise sensitive uses to sites away from roadways and rail corridors.

As noted, the implementation of noise mitigation will, in some cases, more than offset the noise impacts of a particular transportation improvement. As a result, the 2001 RTP has the potential to bring noise abatement benefits to communities that currently experience noise problems resulting from existing traffic.

SIGNIFICANCE AFTER MITIGATION

These mitigation measures would be expected to reduce potentially significant noise impacts to a less-than-significant level if incorporated by project sponsors.

CUMULATIVE IMPACT

2.8-3 Forecast population and employment growth that would be served by transportation improvements in the 2001 RTP will result in increased traffic volumes along a number of transportation corridors in the Bay Area and could, in turn, increase noise levels along some of these corridors.

MITIGATION MEASURES

Except where future transportation improvements create the need for noise mitigation, increased noise in other parts of the Bay Area would not necessarily be mitigated unless communities and local transportation authorities: 1) determine that a noise problem exists and that the problem is one of a perceptible nature, and 2) identify local or other transportation funds not currently included in the proposed RTP to provide the necessary mitigation. In many corridors the projected traffic increases are unlikely to produce perceptible increases in noise since there may not be any sensitive receptors nearby and the increased volumes would not trigger a significant impact.

SIGNIFICANCE AFTER MITIGATION

These mitigation measures are not expected to reduce all potentially significant cumulative noise impacts to a less-than-significant level, since there may be locations where a current or future problem exists and there is no funding identified to provide the necessary mitigation.

2.9 Cultural Resources

In the context of this EIR, cultural resources are described as the material remains identified with either the prehistoric inhabitants of the area (any time prior to the arrival of the Spanish in the latter half of the 18th century) or with the historic inhabitants. The historic period begins with the arrival of the Spanish and continues up to 45 years ago, a definition that is recognized under both CEQA and NEPA guidelines. While there are procedural differences between the State and federal guidelines, both establish the conditions under which a particular resource is significant and requires mitigation as part of a proposed plan or project.

SETTING

The moderate climate combined with the abundant natural resources found throughout the nine-county region have supported human habitation for several thousand years Before Present (BP). Some theories suggest that the prehistoric bay and river margins were inhabited as early as 10,000 years ago.[1] Rising sea levels, the formation of the San Francisco Bay, and the resulting filling of inland valleys have covered these early sites, which were most likely located along the then existing bayshore and waterways. Existing evidence indicates the presence of many village sites from at least 5,000 years BP in the region. The arrival of Native Americans into the Bay Area is associated with documented cultural resources from circa 5,500 BP.[2]

Six different groups of Native population, identified by their language, lived within the Bay Area, including Costanoan, Eastern Miwok, Patwin, Coast Miwok, Pomo and Wappo. These Native populations periodically increased between 5,000 BP and the arrival of the Spanish in the late 18th century. Native villages and campsites were inhabited on a temporary basis and are found in several ecological niches due to the seasonal nature of their subsistence base.

By the end of the first millennium A.D., population densities had grown to the point where less favorable environmental settings were being used for habitation. Groups competed for the hunting grounds, seed and acorn gathering areas and other areas necessary to a hunting and gathering culture. Remains of these early peoples indicate that main villages, seldom more than 1,000 residents, were usually established along water courses and drainages. Remains of satellite villages have been found in areas used for procurement of food or other resources. By the late 1760s about 300,000 Native Americans lived in California.[3]

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[1] EIP Associates, Ranier Avenue Cross Town Connector and U.S. 101 Interchange Project DEIR, prepared for the City of Petaluma, July 1993.

[2] U.S. Dept. of Interior, MMS - Pacific OCS Region. California, Oregon, and Washington Archaeological Resource Study. November 1990.

[3] ABAG. Status and Trends Report on Land Use and Population - The Geomorphology, Climate, Land Use and Population Patterns in the San Francisco Bay, Delta and Central Valley Drainage Basins. February 1991.

THE EARLY MISSIONS – CIRCA 1760 TO 1790

The arrival of the Spanish and the development of the mission system in the latter half of the 18th Century permanently disrupted the indigenous societies flourishing in the area. The San Francisco Mission (Mission San Francisco de Asis or Mission Dolores) and the Presidio (Yerba Buena) were founded in 1776. Both the Mission Santa Clara and the Pueblo de San Jose de Guadalupe were founded in 1777 in Santa Clara County. The introduction of the infrastructure necessary to maintain the missions caused historic alterations to the landscape. The early Native American settlements were abandoned and replaced with cultivated orchards, productive agricultural land, cattle grazing, and housing, outposts, and military support for the missions. These uses combined with the clearing of woodlands for fuel and lumber caused rapid changes to the natural environment. Native vegetation became displaced by imported grasses and plants spread by the settlers and their livestock.

FROM THE MISSION ERA TO THE GOLD RUSH – CIRCA 1790 TO 1847

After the Mexican revolt against Spain in 1822, California lands came under Mexican rule. Large tracts of land, including the former missions, were granted to individual owners. Agriculture, grazing, and mining activities increased, leading to the establishment of more permanent settlements and urban centers. These changes accelerated the degree of physical change occurring to the natural landscape. It is from this era that most of the historic ranch lands and associated living quarters and operational structures originate. It is also during this era that San Francisco became a transportation hub, shipping hides and other local raw materials to the manufacturing centers of New England.

THE GOLD RUSH – 1847 TO 1860

The discovery of gold and ensuing "gold rush" in the late 1840s brought thousands of prospectors and settlers into California. The Bay Area became the gateway to the gold of the Sierra Nevada. The conveyance of people, mining equipment, and food to the gold fields established some of the transportation corridors still in use today. Rapid growth occurred in several of the Bay Area's fledgling cities, with the focus on San Francisco as a shipping and financial center. Today the structures and sites from this remaining period are often considered to be of historic significance.

THE AGRICULTURAL ERA – CIRCA 1860 TO 1900

The economic engine created by the gold rush was supplanted by increased agricultural production. Inland valleys were plowed for wheat, fruit, and vegetable cultivation and the construction of levees in the Sacramento/San Joaquin delta reclaimed wetland areas for field crops and orchards. The completion of the intercontinental railroad to San Francisco by 1888 assured the Bay Area's continued prominence as an economic and population center for the West in general and for California. The buildings, structures, and objects that are associated with the aforementioned industries, irrigation, and transportation of this period may be of historic significance.

THE MANUFACTURING ERA – CIRCA 1900 TO 1950

The economic base of the Bay Area continued to grow and diversify throughout the 1900s. Urban areas continued to grow in accordance with transportation corridors. The rail lines of the early 1900s supported new development along their routes, with residential and business centers at their stops. The development of the automobile and subsequent emphasis on roadway construction allowed population and economic centers to develop independent of rail corridors and at greater and greater distances from one another. Cultural resources from this era could include sites and structures associated with industrial development (i.e., railroad and maritime industries) and with prominent citizens of the time.

THE POST-WAR ERA – 1950s TO PRESENT

After World War II, major growth occurred in suburban areas. Military installations constructed during the war years contributed to the area's economic base. Economic diversification included the growth of high-technology (computers) manufacturing, service and business offices, and tourism. Major residential growth occurred in outlying suburban areas, causing loss of lands historically used for cattle grazing, orchards, or other agricultural activities. A regional development pattern emerged of economic/employment centers served by satellite "bedroom" or mostly residential communities. A regional freeway system supplemented local streets and thoroughfares increasing mobility throughout the Bay Area. Cultural resources associated with this area are likely to be associated with historic farms and ranches and structures exemplifying modern engineering and architectural trends. In general, sites and structures are not considered eligible for historic designation unless they are at least 40 years old and meet specific local, state, or national criteria.

RECORDED REGIONAL RESOURCES

The interpretations and designations of archaeological resources in the Bay Area are documented at the Northwest Information Center at Sonoma State University. This information reflects the presence of known archaeological sites; known geological, soil, biological, hydrological, and topographical features; and the experience of archaeologists familiar with the field occurrences of such resources in the Bay Area.

As shown in Table 2.9-1, approximately 6,800 Native American and historic cultural resources have been recorded in the Bay Area and are listed with the Historical Resources Information System. Currently, some 760 cultural resources are listed on the National Register of Historic Places, of which approximately 240 are designated California Historic Landmarks. The California Inventory of Historic Resources includes a total of about 820 historic buildings, sites, or objects and 2,340 archaeological sites. The greatest concentration of listed historic resources occurs in San Francisco, with 171 sites on the National Register. Alameda County has the second highest number of listed historic resources with 138. In addition to national and State historic preservation legislation, many Bay Area counties and communities have enacted local ordinances that recognize and preserve historic sites. San Francisco, Sonoma, Napa, and San Mateo counties all have county-wide historic preservation programs and at least 30 cities have their own historic preservation ordinances.[4]

LOCATIONS

Dense concentrations of the Native American archaeological sites occur along the historic margins of San Francisco and San Pablo Bays. In addition, archaeological sites have also been identified in the following environmental settings in all Bay Area counties:

- Along historic bayshore margins;
- Near sources of water, such as vernal pools and springs;
- Along ridgetops and on midslope terraces;
- At the base of hills and on alluvial flats.

Native American archaeological sites have also been identified buried under a few inches to several feet of native and imported soils along the margins of San Francisco Bay, and in the valleys of all of Bay Area counties. Remains associated with a Native American archaeological site may include chert or obsidian flakes, projective points, mortars and pestles, and dark friable soil containing shell and bone dietary debris, heat-affected rock, or human burials.

Dense concentrations of historic archaeological resources are often found in large urban areas and smaller cities that experienced growth and development during the historic period. Historic archaeological resources are also found in rural settings where homesteads, ranches, or farms were once present. Historic archaeological remains may include stone or adobe foundations or walls, structures and remains with square nails, and refuse deposits often in old wells and privies.

This study does not attempt to evaluate the significance of any of the cultural resource materials recorded within or related to the individual roadway and transit projects that are the focus of this study. When prehistoric or historic sites are identified, detailed field-level evaluation is required to determine the significance of the contents of any remains. Archival research is needed in the case of identified but unprotected archaeological sites and buildings, sites, or objects to determine the role played by the location and its contents in the local history of an area, or their associations with important persons and events of local importance. Many of the recorded prehistoric and historic sites in the Bay Area have not received this level of detailed analysis. Detailed evaluation must be conducted before mitigation measures can be finalized for those resources that will be damaged by actual construction.

[4]Including Alameda, Berkeley, Calistoga, Campbell, Dixon, Gilroy, Half Moon Bay, Healdsburg, Hillsborough, Larkspur, Livermore, Menlo Park, Mill Valley, Morgan Hill, Napa, Oakland, Palo Alto, Petaluma, Redwood City, San Anselmo, San Jose, San Mateo, Santa Clara, Santa Rosa, Sebastopol, Sonoma, South San Francisco, St. Helena, Sunnyvale, Vacaville, Vallejo, Yountville. Source: 1998 RTP EIR.

Table 2.9-1: Recorded Archaeological and Historical Sites in the Bay Area

	County								
Source of Record	*Alameda*	*Contra Costa*	*Marin*	*Napa*	*San Francisco*	*San Mateo*	*Santa Clara*	*Solano*	*Sonoma*
Recorded Prehistoric and Historic Archaeological[1]	632	754	644	914	126	364	802	412	2,206
Cultural Resources listed individually on the National Register of Historic Places and the California Register of Historic Places[2,3]	138 BSO	41 BSO	48 BSO 4 AS	79 BSO	171 BSO 5 AS	50 BSO 1 AS	136 BSO 2 AS	36 BSO	65 BSO 4 AS
California Historic Landmarks[4]	30 BSO 1 AS	14 BSO	14 BSO	17 BSO	48 BSO	34 BSO	43 BSO	14 BSO	27 BSO
Listings on the California Inventory of Historical Resources	221 BSO 344 AS	108 BSO 352 AS	30 BSO 413 AS	31 BSO 328 AS	141 BSO 26 AS	75 BSO 152 AS	149 BSO 61 AS	30 BSO 264 AS	33 BSO 400 AS
Bridges Listed on the Caltrans Local Bridge Survey[5]	286	322	120	102	49	127	406	162	406

Abbreviations: BSO (Building, Site, or Object); AS (Archaeological Site).
[1] Northwest Information Center, 2001.[n1]
[2] State Office of Historic Preservation, 1998.
[3] Not included here are a category of 3,142 resources that have been listed as contributors to an Archaeological or Historic District and another set of 806 resources that have been determined to be eligible for listing on the National Register or the California Register of Historic Places.
[4] State Office of Historic Preservation, 1996.
[5] Caltrans Local Bridge Survey, 1989.

Source: Northwest Information Center, Sonoma State University, 2001.

CRITERIA OF SIGNIFICANCE

This EIR will use the following criteria to assess whether the 2001 RTP will have a significant adverse effect on cultural resources in the Bay Area:

- **Criterion 1: Substantially changes the significance of a historical resource.** Implementation of the 2001 RTP would have a potentially significant impact if it causes a substantial adverse change in the significance of a historical resource.
- **Criterion 2: Substantially changes the significance of an archaeological resource.** Implementation of the 2001 RTP would have a potentially significant impact if it causes a substantial adverse change in the significance of an archaeological resource.
- **Criterion 3: Destroys a unique paleontological resource.** Implementation of the 2001 RTP would have a potentially significant impact if it directly or indirectly destroys a unique paleontological resource or site or unique geologic feature.
- **Criterion 4: Disturbs human remains.** Implementation of the 2001 RTP would have a potentially significant impact if it disturbs any human remains, including those interred outside of formal cemeteries.

Generally under CEQA, a resource is considered "historically significant" if it meets the requirement for listing on the California Register of Historical Resources, which involves the following:

Criteria for Evaluating the Significance of Historic Resources. An historical resource must be significant at the local, state, or national level under one or more of the following four criteria:

1. It is associated with events that have made a significant contribution to the broad patterns of local or regional history, or the cultural heritage of California or the United States;
2. It is associated with the lives of persons important to local, California, or national history;
3. It embodies the distinctive characteristics of a type, period, region, or method of construction, or represents the work of a master or possesses high artistic values; or
4. It has yielded, or has the potential to yield, information important to the prehistory or history of the local area, California, or the nation.[5]

Finally, in addition to determining the significance and eligibility of any identified historical resource under CEQA and the California Register, historic properties must be evaluated under the criteria for the National Register of Historic Places should federal funding or permitting become involved in any undertaking subject to this document.

[5] California Public Resources Code, Chapter 14, Adopted Chapter 11.5, Section 4852(b).

METHOD OF ANALYSIS

It is recognized that important cultural resources may be encountered during ground-disturbing construction work on any project comprising the 2001 RTP. It is also recognized that projects associated with the operation and maintenance of the transportation system, such as signalization, equipment replacement, and pavement maintenance, would not directly affect cultural resources. Since the specific locations of cultural resources are not mapped, and since the extent of ground disturbance associated with various 2001 RTP projects is unknown at this time, it is not possible to assess the specific impacts on cultural resources based on the location of these projects. Accordingly, no project-specific reviews or field studies have been undertaken for this program EIR. However, CEQA mandates the review of all 2001 RTP projects for potential environmental impacts, and projects that involve ground-disturbing activities will generally require a records search and/or field review by qualified professionals to identify potential cultural resource impacts.

SUMMARY OF IMPACTS

While project-specific studies will be necessary to determine the actual potential for significant impacts on cultural resources resulting from the implementation of the transportation improvements in the 2001 RTP, some general impacts can be assumed based on the general type and location of the improvements. Projects located in the vicinity of historic bayshore margins, existing or historic water courses, along ridgetops, at the base of hilltops, and on alluvial flats are most likely to encounter cultural resources. Projects involving improvements within existing urban areas, within existing transportation corridors, or to existing infrastructure or operations are less likely to impact cultural resources since these projects are located in already-disturbed areas that may have been subject to previous cultural resource surveys. However, since most transportation corridors follow valleys and drainage areas, and since archaeological resources are scattered throughout the Bay Area, many of the proposed construction-related projects in 2001 RTP have a potential for significant impacts.

DIRECT IMPACTS

Implementation of the transportation improvements in the 2001 RTP could result in both short term and long term impacts on cultural resources. However, since most of the Bay Area has not been systematically surveyed for cultural resources, it is not possible to determine what the direct impacts would be in the project specific area.

Short Term Impacts

The construction of transportation improvements in the 2001 RTP could result in impacts on cultural resources if construction activities include the disturbance of the existing terrain. Likewise, the establishment of staging areas, temporary roads, and any other temporary facilities necessary for construction activities also have the potential to impact these cultural resources.

Long Term Impacts

Table 2.9-2 identifies proposed transportation improvements in the 2001 RTP that could result in a potential significant impact on cultural resources. Such projects—located in areas with known historical sites, or located in communities with established historic preservation programs, or involving activities that would disturb the existing terrain—are likely to result in significant impacts on cultural resources. A higher incidence of impacts to historical sites is expected to occur in urban areas settled or developed more than 40 years ago. However, projects traversing rural lands could also have significant impacts on sites that are singular examples of an historical setting. Both urban and rural projects could impact archaeological and paleontological resources.

Table 2.9-2: 2001 RTP Projects with Potentially Significant Impacts on Cultural Resources

Corridor/Subarea	*Project*	*Potential Impact*
Golden Gate	Northbound and southbound HOV lanes between Marin County line and Old Redwood Highway	This project would widen the freeway (primarily in the median) and could affect archaeological and historical resources if present.
	Widen US 101 from 4 to 6 lanes between Rte. 37 and Sonoma County line	This project would widen the freeway (primarily within existing right-of-way) and could affect archaeological and historical resources if present.
North Bay East-West	Widen Rte. 12 from 2 to 4 lanes between I-80 and Rte. 29 (Jameson Canyon)	This project would widen the highway and could affect archaeological and historical resources if present.
Napa Valley	New Rte. 221/Rte. 29 flyover	Construction of elevated structure could affect archaeological resources if present.
Eastshore-North	Vallejo intermodal transit facility	Construction of transit facility could affect archaeological and historical resources if present.
	Hercules transit center	Construction of transit center could affect archaeological and historical resources if present.
	New Amtrak Capitol rail stations with potential sites in Fairfield/Vacaville, Dixon and Benicia	Construction of new stations could affect archaeological and historical resources if present.
Diablo	Martinez intermodal terminal facility	Construction of parking facility could affect archaeological and historical resources if present.
Tri-Valley	New West Dublin-Pleasanton BART station	Construction of associated parking structures and transit-oriented development could affect archaeological and historical resources if present.
	MacArthur BART station intermodal transit village	Construction of transit village could affect archaeological and historical resources if present.
Eastshore-South	BART-Oakland International Airport	Construction of elevated structures

Table 2.9-2: 2001 RTP Projects with Potentially Significant Impacts on Cultural Resources

Corridor/Subarea	*Project*	*Potential Impact*
	connector	could affect archaeological and historical resources if present.
Fremont-South Bay	New underpass on Paseo Padre Pkwy. at railroad tracks and overpass at Washington Blvd. with 2-mile track relocation	Construction of structures and track relocation could affect archaeological and historical resources if present.
	BART to Warm Springs	Construction of elevated structures and tunnels could affect archaeological and historical resources if present.
	Silicon Valley Rapid Transit Corridor Project (Project A)	Construction of elevated structures and tunnels could affect archaeological and historical resources if present.
Silicon Valley	Rte. 25 upgrade to expressway from Bloomfield Ave. to San Benito County line	This project would widen the highway and affect archaeological and historical resources if present.
Peninsula	Northbound and southbound auxiliary lanes between Sierra Pt. Pkwy. and San Francisco County line	This project would widen the freeway and could affect archaeological and historical resources if present.
San Francisco	Third St. Light Rail – Central Subway (Project A)	This project would establish a tunnel from Market St. to Union St. and could affect archaeological and historical resources if present.

Source: Dyett & Bhatia, 2001.

The degree and extent of impacts that could result from the implementation of the 2001 RTP will depend upon project-specific analysis to determine whether the value—i.e., the eligibility for local, State, or national recognition—of any cultural resource identified within a proposed alignment or project area. However, given the magnitude and location of several transportation improvements in the 2001 RTP, and given the number of projects involving construction activities, it is possible that implementation of these improvements would result in unquantified significant impacts on cultural resources.

INDIRECT/CUMULATIVE IMPACTS

Implementation of the transportation improvements in the 2001 RTP could result in indirect impacts on cultural resources by serving forecast urban development that could, when it occurs, have the potential to disturb, destroy, or significantly affect cultural resources. To the extent that the transportation improvements in the 2001 RTP, in aggregate, would serve new forecast urban development, it would add to cumulative regional impacts. In addition, other transportation improvements in the 2001 RTP not identified as having a direct impact on cultural resources in the regional context may result in individually minor impacts locally. Collectively, these individually minor impacts on cultural resources may become significant over time.

SIGNIFICANT IMPACTS AND MITIGATION MEASURES

IMPACT

2.9-1 Individual transportation improvements in the 2001 RTP that involve ground disturbing activities have the potential to disturb, destroy, or significantly affect cultural resources.

MITIGATION

MTC shall require that project sponsors comply with CEQA (and NEPA if appropriate) prior to project approval by MTC. Project sponsors shall commit to mitigation measures at the time of certification of their project environmental document. These commitments obligate project sponsors to implement measures that would minimize or eliminate any significant impacts on cultural resources. Typical mitigation measures that can be considered by project sponsors include:

- Site evaluation to determine an area of potential effect, including activities related to construction and the extent of post-construction impacts, for any site that requires grading or subsurface disturbance.
- Review through the Northwest Information Center at Sonoma State University to determine the potential for, or existence of, cultural resources.
- Evaluation to determine the significance (as defined by then-current CEQA and National Historic Preservation Act guidelines) of cultural resources identified within the area of potential effect.
- Assessment by a qualified professional of sites or corridors with no identified cultural resources, but a moderate to high potential for archaeological resources.
- Assessment by a qualified professional of structures greater than 40 years in age within the area of potential effect to determine their eligibility for recognition under State, federal, or local historic preservation criteria.
- Project-specific environmental documents should require that if evidence of a cultural resource is found during construction the following actions shall be implemented:
  - Cessation of construction activities.
  - Evaluation by a professional archaeologist or historian to evaluate the value of the resources found and to advise on a plan to preserve resources determined to be of significance.

SIGNIFICANCE AFTER MITIGATION

These mitigation measures would be expected to reduce this potentially significant impact on cultural resources to a less-than-significant level if incorporated by transportation project sponsors. It is not expected that these mitigation measures would eliminate all impacts on cultural resources.

CUMULATIVE IMPACT

2.9-2 Forecast urban development that would be served by transportation improvements in the 2001 RTP could, when it occurs, have the potential to disturb, destroy, or significantly affect cultural resources.

MITIGATION

Local land use agencies are responsible for the approval of forecast urban development and for determining appropriate mitigation during their CEQA processes. In addition, local historic preservation regulations, where they exist, would apply to such development.

SIGNIFICANCE AFTER MITIGATION

These mitigation measures are not expected to reduce this potentially significant cumulative impact on cultural resources to a less-than-significant level, since the cumulative effect of forecast development would be to impact cultural resources in many parts of the Bay Area over the next 25 years.

2.10 Population, Housing, and Social Environment

This chapter describes the projected population and employment growth for the Bay Area between now and 2025 and the location of the projected growth within the region. It also discusses various population characteristics (e.g., age, ethnicity, and income), housing trends, and identifies the location of low income and minority communities. Potential impacts on the Bay Area population from transportation improvements include displacement of homes and businesses and the potential for disruption of communities if new transportation infrastructure separates people and community resources, such as shopping, parks, adjacent neighborhoods, or community services. In addition, the RTP would have a significant impact if it stimulates substantial and unplanned population growth in the region as a whole.

It is noted that the evaluations and analysis of this impact area are based on general descriptions of the 2001 RTP projects and are regional in nature. They are not intended to satisfy any requirements for site-specific analysis of individual projects, which are by themselves, subject to CEQA.

SETTING

POPULATION AND EMPLOYMENT GROWTH

The Bay Area's population has increased by 90 percent over the previous 40 years, while jobs have increased 200 percent. Looking ahead to the next 25 years, the Association of Bay Area Governments (ABAG) projects that the Bay Area's population will grow another 18.5 percent (1.3 million more residents) and employment will increase by another 33 percent (1.2 million additional jobs).

During the past 40 years, the locations of people and jobs have become much more dispersed as new urban centers have formed and cities have gained population on the edge of the region. This shift in growth patterns is illustrated in Tables 2.10-1 and 2.10-2. Santa Clara County is now the most populous county in the Bay Area and is home to about 25 percent of the region's residents. The county's largest city, San Jose, is also the largest city in the Bay Area with a population of 895,000 or about 13 percent[1] of the region's residents. Currently, there are 12 cities in the Bay Area of more than 100,000 residents.

Table 2.10-2 shows that similar to the population trends, jobs are also redistributing between areas. Three counties, Santa Clara, Alameda , and San Francisco account for two thirds of all the Bay Area jobs. ABAG projects that Solano and Napa Counties will have the greatest rate of job

[1] Census 2000.

growth in the coming 25 years, at 63 percent and 50 percent respectively.[2] The cities gaining the largest number of people and jobs over the next 25 years are shown in Tables 2.10-3 and 2.10-4.

Table 2.10-1: Population Growth in the Bay Area (1980-2025)

County	*1980*	*2000*	*2025*	*Growth: 1980-2000*	*Growth: 2000-2025*	*% of Total 2000*	*% of Total 2025*
Alameda	1,105,379	1,462,695	1,701,599	357,316	238,904	21	21
Contra Costa	656,380	941,900	1,213,899	285,520	271,999	14	15
Marin	222,568	250,402	278,401	27,834	27,999	4	3
Napa	99,199	127,600	165,601	28,401	38,001	2	2
San Francisco	678,974	799,009	804,804	120,035	5,795	12	10
San Mateo	587,329	737,095	823,901	149,766	86,806	11	10
Santa Clara	1,295,071	1,755,333	2,062,906	460,262	307,573	25	25
Solano	235,203	401,300	581,400	166,097	180,100	6	7
Sonoma	299,681	455,305	591,597	155,624	136,292	7	7
Region	***5,179,784***	***6,930,639***	***8,224,108***	***1,750,855***	***1,293,469***	***100***	***100***

Source: ABAG, Projections 2000 (modified to 2025 by MTC).

Table 2.10-2: Job Growth in the Bay Area (1980-2025)

County	*1980*	*2000*	*2025*	*Growth: 1980-2000*	*Growth: 2000-2025*	*% of Total 2000*	*% of Total 2025*
Alameda	513,800	725,789	991,191	211,989	265,402	20	20
Contra Costa	201,200	360,090	537,386	158,890	177,296	10	11
Marin	77,900	123,510	156,993	45,610	33,483	3	3
Napa	35,900	59,710	95,999	23,810	36,289	2	2
San Francisco	552,200	628,860	747,291	76,660	118,431	17	15
San Mateo	259,800	380,369	470,291	120,569	89,922	10	10
Santa Clara	702,900	1,077,227	1,353,591	374,327	276,364	29	28
Solano	90,800	129,510	228,397	38,710	98,887	4	5
Sonoma	103,400	203,530	325,690	100,130	122,160	6	7
Region	***2,537,900***	***3,688,595***	***4,906,829***	***1,150,695***	***1,218,234***	***100***	***100***

Source: ABAG, Projections 2000 (modified to 2025 by MTC).

[2] ABAG. Projections 2000: Forecasts for the San Francisco Bay Area to the year 2020, 1999. (modified to 2025 by MTC).

Table 2.10-3: Top Ten Bay Area Cities by Population Growth (2000-2025)

City	*2000-2025 Change*
San Francisco	102,800
San Jose	99,420
Santa Rosa	43,740
Fremont	35,400
Oakland	29,450
Fairfield	29,120
Santa Clara	26,480
Pleasanton	24,540
Alameda	24,380
San Ramon	22,390

Source: ABAG, Projections 2000 (modified to 2025 by MTC).

Table 2.10-4: Top Ten Bay Area Cities by Employment Growth (2000-2025)

City	*2000-2025 Change*
San Jose	129,300
Fairfield	49,100
Oakland	37,500
Santa Rosa	36,800
Dublin	35,100
San Ramon	34,800
Antioch	31,300
Vacaville	30,300
Santa Clara	29,000
Brentwood	27,400

Source: ABAG, Projections 2000 (modified to 2025 by MTC).

Age

The median age of the population rose from 33 to 36 over the past decade.[3] As illustrated in Table 2.10-5, which compares the 1990 age distribution to the 2000 age distribution estimates, the region has shown a slight increase in the percentage of the population over the age of 65. As the Baby Boomers age, the proportion of the population group over 65 is projected to increase 87.5 percent to 1,540,300 people (19 percent of the total population) by 2020. About 43 percent of the

[3] Ibid.

population over 65 will be over age 75, and much less likely to drive.[4] This aging trend is likely to pose a greater demand for specialized transportation services.

A corollary trend is the decrease in the percentage of population in the working age brackets – ages 20 to 64. As the baby boomers continue to age, this percentage will continue to decrease and it is unlikely that the next generation will replenish the workforce. Rather, the most likely source of workers to fill new jobs will come from other adjacent counties.

Table 2.10-5: Age Distribution in the Bay Area

	County (Percent in 1990/2000)									
Age Category	*Alameda*	*Contra Costa*	*Marin*	*Napa*	*San Francisco*	*San Mateo*	*Santa Clara*	*Solano*	*Sonoma*	*Region*
Under 19	26/29	28/28	21/23	26/26	18/21	24/27	27/28	32/32	27/27	26/27
Age 20-64	63/60	61/60	67/63	58/58	67/63	63/60	64/61	60/59	59/60	63/61
Over 65	11/11	11/12	12/14	17/17	15/15	12/13	9/10	8/9	13/13	11/12

Due to rounding not all columns may total 100 percent.

Source: ABAG, Projections 2000.

Ethnicity

Since 1990, the Bay Area has grown more diverse, notably through the increase in Asian and Hispanic residents. Census 2000 figures show that non-Hispanic whites have decreased to about 50 percent of the population in 2000. By 2020, non-Hispanic whites will constitute only 41 percent of the population. By 2020, Asian and Indian populations will constitute around 27 percent of the population, Latinos around 24 percent and African Americans about 8 percent. Of these groups, the proportion of Asians living in the Bay Area is much greater than the proportion of Asians in California.

Income/Car Ownership

Mean household income is expected to increase by 24 percent in real dollars between 2000 and 2025. Although increases in wealth are not likely to be evenly distributed among age groups and ethnic groups, rising income indicates a higher potential for car ownership. As a result, while approximately 8.9 percent of Bay Area households currently do not own a vehicle, this percentage is projected to decrease to 7.6 percent by 2020.

Jobs and Housing

Over the last ten years the supply of affordable housing in the Bay Area has not kept pace with job growth. Thus, new workers filling jobs must either pay very high prices to own or rent housing near their places of employment or move further away from employment centers and face

[4] ABAG, Projections 2000 (modified to 2025 by MTC).

correspondingly longer commutes. The greatest projected need for additional housing according to ABAG is in Santa Clara and Alameda counties, where many of the jobs are found.[5]

Table 2.10-6 compares the number of employed residents with the number of jobs projected for each county and provides an indication of which counties are exporters of workers and which counties import workers by virtue of having more jobs than employed residents. For the Bay Area as a whole, there will be more jobs in 2025 than employed residents, resulting in about 280,000 commuters coming from outside the Bay Area to fill jobs within the nine county region.

Table 2.10-6: Population and Employment by Bay Area County – Net Importers/Exporters of Workers (Year 2000 and 2025)

	Year 2000			
County	*Employed Residents*	*Jobs*	*Difference*	*Imports/Exports workers*
San Francisco	422,100	628,860	206,760	IMPORTS
San Mateo	393,703	380,369	-13,334	EQUAL[1]
Santa Clara	928,699	1,077,227	148,528	IMPORTS
Alameda	694,602	725,789	31,187	IMPORTS
Contra Costa	475,888	360,090	-115,798	EXPORTS
Solano	185,606	129,510	-56,096	EXPORTS
Napa	61,598	59,710	-1,888	EQUAL[1]
Sonoma	235,400	203,530	-31,870	EXPORTS
Marin	140,401	123,510	-16,891	EXPORTS
Region	***3,537,997***	***3,688,595***	***150,598***	***IMPORTS***
	Year 2025			
County	*Employed Residents*	*Jobs*	*Difference*	*Imports/Exports Workers*
San Francisco	464,998	747,291	282,293	IMPORTS
San Mateo	485,506	470,291	-15,215	EQUAL[1]
Santa Clara	1,187,219	1,353,591	166,372	IMPORTS
Alameda	909,708	991,191	81,483	IMPORTS
Contra Costa	680,507	537,386	-143,121	EXPORTS
Solano	305,049	228,397	-76,652	EXPORTS
Napa	90,101	95,999	5,898	EQUAL[1]
Sonoma	333,197	325,690	-7,507	EQUAL[1]
Marin	168,901	156,993	-11,908	EQUAL[1]
Region	***4,625,186***	***4,906,829***	***281,643***	***IMPORTS***

[1] Defined as difference of 15,000 or less.

Source: ABAG, Projections 2000 (modified to 2025 by MTC).

[5] ABAG, *Regional Housing Needs Determination Allocation*, released 3/15/01.

The jobs/housing ratio can also be displayed in more detail by MTC superdistricts, as shown in Table 2.10-7. In theory, a 1:1 ratio would indicate balance and improved opportunities for reduced commuting distances when the types of jobs match the skills of the local residents (although commuting is not reduced where there are mismatches between jobs and worker skills and income and housing affordability). Table 2.10-8 shows the current and projected jobs-housing balance by Bay Area County.[6]

SOCIAL ENVIRONMENT

Although displacement of homes and businesses or community disruption by major transportation projects may be a significant impact for any community, such displacement or disruption could potentially have a greater adverse impact on low income and minority communities. This is because persons in these communities may be more constrained in finding appropriate new living situations, paying the costs of relocation, getting to businesses that are relocated, or establishing new businesses. For this reason, the EIR identifies projects that could potentially affect low income and minority communities as defined for the RTP Equity Analysis (this is a separate analysis from the EIR and is intended to respond to federal planning guidelines). These definitions are:

- ***Minority.*** The term "minority" refers to: African American, Asian American, Hispanic, and Native American. To identify zones in the Bay Area with a high percentage of minority population, a 70 percent population share was used (compared to a 50 percent average for the Bay Area as a whole).

- ***Low Income:*** Low income is defined as a person whose household income is at or below the US Department of Health and Human Services Poverty Guidelines. Because the Bay Area has a relatively high cost of living the RTP Equity Analysis defined zones where 30 percent or more of the population was below 200 percent of the federal poverty guidelines.

The resulting map which combines both definitions is shown in Figure 2.10-1.

[6] The MTC divides the Bay Area into 34 "superdistricts." These superdistricts reflect the conglomeration of some 1,099 transportation analysis zones (TAZ) and are used in analysis, calibration, and presentation of MTC's transportation model (BAYCAST-90) output.

Table 2.10-7: Current and Projected Jobs/Housing Balance by MTC Superdistrict

		2000			2025			
	Superdistrict	*Employed Residents*	*Jobs*	*Jobs/Employed Residents*	*Employed Residents*	*Jobs*	*Jobs/ Employed Residents*	*Difference*
1	Downtown San Francisco	65,255	380,367	5.83	75,699	438,366	5.79	-0.04
2	Richmond District	127,244	81,706	0.64	137,177	98,051	0.71	0.07
3	Mission District	161,572	139,371	0.86	179,741	179,615	1.00	0.14
4	Sunset District	68,029	27,416	0.40	72,381	31,259	0.43	0.03
5	Daly City/San Bruno	157,267	163,342	1.04	188,906	201,834	1.07	0.03
6	San Mateo/Burlingame	121,402	104,309	0.86	151,793	128,170	0.84	-0.01
7	Redwood City/Menlo Park	115,034	112,718	0.98	144,807	140,287	0.97	-0.01
8	Palo Alto/Los Altos	99,656	166,624	1.67	121,061	184,484	1.52	-0.15
9	Sunnyvale/Mountain View	139,169	395,541	2.84	191,046	482,659	2.53	-0.32
10	Saratoga/Cupertino	181,853	150,443	0.83	220,884	180,315	0.82	-0.01
11	Central San Jose	150,846	153,003	1.01	192,386	188,674	0.98	-0.03
12	Milpitas/East San Jose	185,381	98,418	0.53	237,569	128,959	0.54	0.01
13	South San Jose/Almaden	122,850	65,962	0.54	149,918	81,237	0.54	0.00
14	Gilroy/Morgan Hill	48,944	47,236	0.97	74,355	107,263	1.44	0.48
15	Livermore/Pleasanton	93,988	117,602	1.25	156,622	204,366	1.30	0.05
16	Fremont/Union City	167,213	131,152	0.78	211,705	188,742	0.89	0.11
17	Hayward/San Leandro	154,970	160,933	1.04	192,914	201,591	1.04	0.01
18	Oakland/Alameda	196,116	209,560	1.07	246,967	268,738	1.09	0.02
19	Berkeley/Albany	82,315	106,542	1.29	101,500	127,754	1.26	-0.04
20	Richmond/El Cerrito	108,620	74,731	0.69	138,392	105,916	0.77	0.08
21	Concord/Martinez	121,660	108,784	0.89	160,723	149,186	0.93	0.03
22	Walnut Creek/Lamorinda	72,897	75,143	1.03	93,901	91,763	0.98	-0.05
23	Danville/San Ramon	68,166	52,481	0.77	111,166	85,683	0.77	0.00
24	Antioch/Pittsburg	104,545	48,951	0.47	176,325	104,838	0.59	0.13
25	Vallejo/Benicia	69,060	46,077	0.67	94,228	73,517	0.78	0.11
26	Fairfield/Vacaville	116,546	83,433	0.72	210,821	154,880	0.73	0.02
27	Napa	42,003	37,268	0.89	61,950	69,140	1.12	0.23
28	St. Helena/Calistoga	19,595	22,442	1.15	28,151	26,859	0.95	-0.19

Table 2.10-7 (Con't): Current and Projected Jobs/Housing Balance by MTC Superdistrict

		2000			2025			
	Superdistrict	*Employed Residents*	*Jobs*	*Jobs/Employed Residents*	*Employed Residents*	*Jobs*	*Jobs/ Employed Residents*	*Difference*
29	Petaluma/Sonoma	85,506	60,586	0.71	122,127	102,868	0.84	0.13
30	Santa Rosa/Sebastopol	111,127	123,841	1.11	148,385	186,696	1.26	0.14
31	Healdsburg/Cloverdale	38,767	19,103	0.49	62,685	36,126	0.58	0.08
32	Novato	33,032	25,988	0.79	40,600	41,491	1.02	0.24
33	San Rafael	59,797	55,384	0.93	71,831	67,652	0.94	0.02
34	Mill Valley/Sausalito	47,572	42,138	0.89	56,470	47,850	0.85	-0.04

Source: ABAG; MTC, 2001.

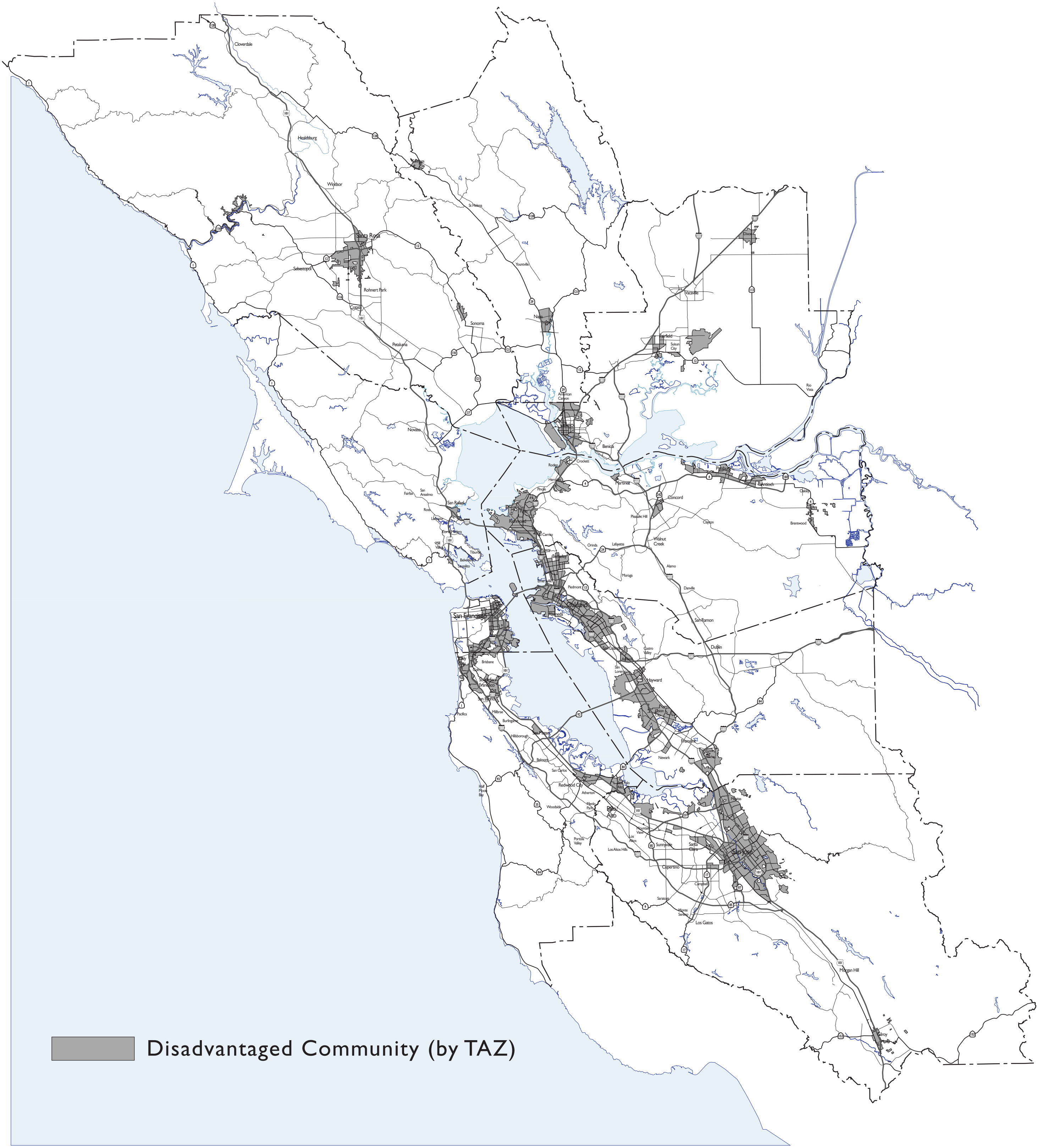
Table 2.10-8: Current and Projected Jobs/Housing Balance by County

	2000			2025			
Superdistrict	*Employed Residents*	*Jobs*	*Jobs/Employed Residents*	*Employed Residents*	*Jobs*	*Jobs/ Employed Residents*	*Difference*
San Francisco	422,100	628,860	1.49	464,998	747,291	1.61	0.12
San Mateo	393,703	380,369	0.97	485,506	470,291	0.97	0.00
Santa Clara	928,699	1,077,227	1.16	1,187,219	1,353,591	1.14	-0.02
Alameda	694,602	725,789	1.04	909,708	991,191	1.09	0.04
Contra Costa	475,888	360,090	0.76	680,507	537,386	0.79	0.03
Solano	185,606	129,510	0.70	305,049	228,397	0.75	0.05
Napa	61,598	59,710	0.97	90,101	95,999	1.07	0.10
Sonoma	235,400	203,530	0.86	333,197	325,690	0.98	0.11
Marin	140,401	123,510	0.88	168,901	156,993	0.93	0.05
Bay Area	***3,537,997***	***3,688,595***	***1.04***	***4,625,186***	***4,906,829***	***1.06***	***0.02***

Source: ABAG; MTC, 2001.

Figure 2.10-1

Disadvantaged Communities in the Bay Area



CRITERIA OF SIGNIFICANCE

Three criteria used to determine significant impacts of the 2001 RTP on population and the disruption of existing residential or commercial neighborhoods are as follows:

- **Criterion 1: Contributes to unplanned population or employment growth.** Implementation of the 2001 RTP would have a potentially significant impact if the transportation improvements lead to substantial, unanticipated increases in population beyond those currently projected.

- **Criterion 2: Causes community displacement.** Implementation of the 2001 RTP would have a potentially significant impact if new construction and/or right-of-way acquisition associated with the 2001 RTP results in residential or business displacement.

- **Criterion 3: Causes community disruption.** Implementation of the 2001 RTP would have a potentially significant impact if it results in permanent alterations to the characteristics and qualities of an existing neighborhood or community, particularly in cases where access to a neighborhood or commercial district is restricted. A significant impact would also result if residences are separated from community facilities and services, or community amenities are lost. Finally, a significant impact would occur if the project results in temporary disruption to or restrict access within neighborhoods or commercial areas during construction. It is assumed that short-term construction impacts are likely to occur at some level for most improvement projects, with the exception of minor operational improvements.

METHOD OF ANALYSIS

With respect to the first criterion (contributes to unplanned population or employment growth) there are a number of factors that affect the overall growth levels of an area, including immigration, birth rates of different segments of the population, housing availability and cost, job opportunities, climate, etc. The quality of the transportation system and the service it provides has a limited role compared to these other factors. To the extent that there is any connection between the level of transportation service and growth, it would be through some form of capacity stimulation. Thus it is possible to compare the projected change in transportation capacity with the expected and planned change in regional population and employment over the next 25 years. Given that this capacity increase has lagged behind growth in the Bay Area, it is unlikely that the modest improvements in the 2001 RTP will generate new and unplanned growth beyond what is already projected by ABAG.

Further the location of growth will be similar to that already projected by ABAG. Since ABAG used the projected travel times from the 1998 RTP in their population and employment allocation model, and since the 2001 RTP does not propose a set of transportation improvements that are significantly different, even from a regional perspective, the 2001 RTP is unlikely to cause shifts in growth that are not already anticipated in ABAG projections.

With criterion 2 (causes community displacement), the potential for displacement of homes and businesses was assessed by first reviewing the 2001 RTP component projects for those that may involve major right-of-way acquisition then further reviewing those projects to identify locations where the right-of-way acquisition could result in the displacement of existing homes and businesses.

Finally, with respect to criterion 3 (causes community disruption), the potential for community disruption was assessed by reviewing the location of specific 2001 RTP projects in relation to surrounding land uses and community development. Highway and transit extensions and major interchange projects were assumed to have a higher potential to disrupt or divide existing communities, while highway widenings and other projects along established transportation rights-of-way were assumed to have a lower potential to divide or disrupt existing communities or neighborhoods.

As noted above, special attention was given to potential impacts on transportation-disadvantaged neighborhoods using data developed for the 2001 RTP by the MTC. The EIR identifies projects that are located in the low income and minority neighborhoods described above, with the intention that future project-level environmental analyses address specific impacts that may result from displacement and community disruption in these areas.

SUMMARY OF IMPACTS

The proposed transportation improvements in the 2001 RTP could result in significant impacts related to the displacement or relocation of homes and businesses as well as community disruption. In some cases, buildings on residential, commercial, and industrial land may have to be removed in order to make way for new or expanded transportation facilities. In other cases, certain transportation improvements could permanently alter the characteristics and qualities of a neighborhood. In any case, the potential for displacement and disruption are major considerations in the final design of the transportation improvements and are addressed in the design and development of mitigation programs. From the regional perspective it is assumed that some residential and commercial displacement and disruption will occur.

The proposed transportation improvements in the 2001 RTP could also result in short term community disruption where such improvements involve significant construction activity. The significance of the disruption will depend upon the size and extent of the improvement, the nature of the disruption, and the duration of construction. While construction activities are typically limited in duration, work on major transportation improvements, such as interchange construction/reconstruction and new rail transit extensions, can span a period of several years.

DIRECT IMPACTS

Implementation of the 2001 RTP could result in both short term and long term impacts on population, housing, and the social environment.

Short Term Impacts

The construction of the transportation improvements in the 2001 RTP could result in short term community disruption. The significance of the disruption will depend upon the size and extent of the improvement, the nature of the disruption, and the duration of construction. This EIR assumes that short term construction impacts are likely to occur at some level for most of the transportation improvements in the 2001 RTP, with the exception of minor operational improvements. Transportation improvements in the 2001 RTP that could result in long term community disruption impacts are identified in Table 2.10-9. In addition to these identified improvements, other projects in each of the nine Bay Area counties could involve locally significant disruption of existing neighborhoods and businesses.

Long Term Impacts

Some transportation improvements in the 2001 RTP could result in the displacement of housing and businesses by requiring removal of buildings on residential, commercial, and industrial lands to make way for new or expanded transportation facilities. Table 2.10-9 identifies those transportation improvements that could result in potentially significant community displacement effects. The actual significance of this impact will depend upon on the final design of the transportation improvements identified and upon the project-specific analysis required by CEQA.

Some improvements could also result in significant and permanent disruption of existing communities; however, the potential for such disruption is minimized as a result of MTC's priority for candidate improvements that are consistent with local general plans, as described in more detail in Chapter 2.11 of this EIR. As a result, proposed transportation improvements with the highest risk of disturbing the fabric and character of existing neighborhoods were rejected or modified at the local level well before they were proposed for inclusion in the 2001 RTP. Historically, transportation improvements with the highest risk of community disruption include new freeways, expressways, or rail lines on alignments that pass through existing urban areas and pockets of development in rural areas. Transportation improvements in the 2001 RTP that could have long term community disruption impacts (not as a result of construction) are identified in Table 2.10-9.

Table 2.10-9: 2001 RTP Projects with Potential to Displace Existing Land Uses and Disrupt Communities

*Indicates projects located in or near disadvantaged communities as shown in Figure 2.10-1.

Corridor	*Project*	*Potential Effect*
Golden Gate	Widen US 101 from 4 to 6 lanes between Rte. 37 and Sonoma County line	Widening could, where it occurs in limited segments outside the median, displace existing residential and business uses.
	US 101 northbound and southbound HOV lanes between Marin County line and Old Redwood Highway	Widening could, where it occurs in limited segments outside the median, displace existing residential and business uses.
	US 101 northbound and southbound HOV lanes between Old Redwood Highway and Rohnert Park Expwy.	Widening could, where it occurs in limited segments outside the median, displace existing residential and business uses. Community disruption could also occur.
	US 101 northbound and southbound HOV lanes between Steele Ln. and Windsor River Rd.*	Widening could displace existing residential and business uses. Community disruption could also occur.
	Widen and channelize southbound US 101 off-ramp to E. Blithedale/ Tiburon Blvd.	Widening could displace existing residential uses.
North Bay East-West	Widen Rte. 12 from 2 to 4 lanes between I-80 and Rte. 29 (Jameson Canyon)	Widening could displace existing agricultural and residential uses. Community disruption could also occur.
Eastshore-North	New Amtrak Capitol rail stations with potential sites in Fairfield/Vacaville, Dixon, and Benicia*	Construction of new facilities could displace an existing tenant on the Fairfield/Vacaville site.
	Widen existing routes (Walters Road, Cement Hill Road, Vanden Road, Leisure Town Road) to create to establish 4 lane Jepson Parkway from Rte. 12 to I-80	Widening of existing routes could displace some existing residential and business uses. Community disruption could also occur.
	Eastbound and westbound HOV lanes between I-680 and I-505	Widening could displace existing residential and business uses in urban areas.
	Richmond Parkway transit center*	Construction of new facilities could displace existing business uses and could divide continuity of existing shopping/ business activities.
	Hercules transit center*	Construction of new facilities could displace existing industrial uses.
Delta	Upgrade Rte. 4 to full freeway from I-80 to Cummings Skyway*	Upgrade could disrupt existing residential and industrial uses in built-up areas and could facilitate urban development in undeveloped areas.
	Widen Rte. 4 eastbound from 4 to 6 lanes between Somersville Rd. and Rte. 160*	Widening could displace existing residential and business uses between Loveridge Rd. and Somersville Rd. Displacement could also

Table 2.10-9: 2001 RTP Projects with Potential to Displace Existing Land Uses and Disrupt Communities

*Indicates projects located in or near disadvantaged communities as shown in Figure 2.10-1.

Corridor	*Project*	*Potential Effect*
		occur at a new L St./Contra Loma interchange. Community disruption could also occur.
Diablo	Widen Pacheco Blvd. to 4 lanes from Blum Rd. to Arthur Rd.	Widening could disrupt existing residential and business uses.
	Commerce Avenue extension between Pine Creek Rd. and Willow Pass Rd.	Extension could disrupt existing mixed uses and business uses.
Tri-Valley	Widen Dublin Boulevard from Village Pkwy. to Sierra Ct.	Widening could displace existing residential and business uses and could divide existing communities.
	Eastbound and westbound HOV lanes between Tassajara Rd. and Vasco Rd.	Widening could displace existing residential and business uses.
Eastshore-South	Widen Rte. 262/Warren Ave./I-880 interchange and East Warren Ave./UPRR grade separation*	Widening could displace existing mixed uses. Community disruption could also occur.
	Widen Union City Blvd. from 4 to 6 lanes from Paseo Padre Ave. to Industrial Pkwy.*	Widening could displace existing residential and business uses and could divide existing communities. Community disruption could also occur.
	Tinker Ave. extension from Main St. to Webster St.	Extension could displace existing public institutional uses. Community disruption could also occur.
	Hayward Bypass (Rte. 238) Harder Ave. to Industrial Pkwy. (Phases II and III)*	New expressway could displace existing residential and business uses could divide existing communities. Community disruption could also occur.
	Widen Thornton Ave. from 2 to 4 lanes between Gateway Blvd. to Hickory St.	Widening could displace existing industrial uses and could divide existing communities. Community disruption could also occur.
Fremont-South Bay	BART to Warm Springs*	Construction of new station and associated facilities could displace existing residential, business, industrial, and agricultural uses and could divide existing communities. Community disruption could also occur.
	Silicon Valley Rapid Transit Corridor Project (Project A)*	Construction of new stations and associated facilities could displace existing residential, business, mixed, and industrial uses and could divide existing communities. Community disruption could also occur.
	Westbound auxiliary lanes on Rte. 237 between Coyote Creek Bridge and North First St.	Widening could displace existing agricultural uses.

Table 2.10-9: 2001 RTP Projects with Potential to Displace Existing Land Uses and Disrupt Communities

*Indicates projects located in or near disadvantaged communities as shown in Figure 2.10-1.

Corridor	*Project*	*Potential Effect*
Silicon Valley	Rte. 25 upgrade to expressway from Bloomfield Ave. to San Benito County line	Upgrade could displace existing residential, business, and agricultural uses. Community disruption could also occur.
Peninsula	US 101 northbound and southbound auxiliary lanes between San Bruno Ave. and Grand Ave.*	Widening could displace existing industrial uses.
	US 101 northbound and southbound auxiliary lanes between Third Avenue and Millbrae/Peninsula Interchange.	Widening could displace existing residential, commercial, and industrial uses.
	US 101 northbound and southbound auxiliary lanes between Marsh Rd. and Santa Clara County line*	Widening could displace existing residential and industrial uses.

Source: Dyett & Bhatia, 2001.

INDIRECT/CUMULATIVE IMPACTS

It is not anticipated that the transportation improvements in the 2001 RTP would induce regionwide population growth, nor would it significantly affect the distribution of population growth forecast for the Bay Area to the year 2025. There are three reasons for this. First, it is evident that transportation investment in general, and increased capacity in particular, currently lag behind the growth that has already occurred in the Bay Area. This situation is likely to continue with limited resources available for system capacity expansion since the 2001 RTP is financially constrained and since the first priority in the 2001 RTP is to maintain and sustain the existing transportation system. Second, due to existing congestion, transportation plays a minimal role in attracting or inducing new development for the region as a whole. Considering the limited funding available over the next 25 years for expansion, improvements in accessibility would be relatively small.

Finally, the transportation improvements in the 2001 RTP are consistent with the projected and planned growth in the Bay Area because the 2001 RTP is a coordinated effort between MTC, ABAG, and local agencies. The 2001 RTP rests on the foundation established in local land use and transportation plans. Thus the 2001 RTP transportation investments, when taken as a whole, reflect growth projections that have been aggregated and refined at the regional level from plans developed at the local level. It is also unlikely that the transportation improvements in the 2001 RTP would substantially modify the location of growth since each RTP update represents the basis for which ABAG makes its projections for the Bay Area. These projections already build accessibility into the assumptions, a factor that generally changes very little from RTP to RTP. To the extent that a specific transportation improvement would remove any obstacles to growth, such a project would have a potentially significant growth-inducing effect. A more detailed discussion of this impact area is included in Part Three of this EIR.

While the transportation improvements in the 2001 RTP are not expected to result in any permanent alterations to the characteristics and qualities of existing neighborhoods or communities or in the separation of homes from community facilities and services, new or expanded transportation facilities could contribute to a perceived change in community character. These perceived changes in community character could also result from the visual effects of the 2001 RTP, as noted in Impact 2.7-1. The mitigation associated with Impact 2.7-1 would be expected to reduce this indirect effect to a less-than-significant level.

SIGNIFICANT IMPACTS AND MITIGATION MEASURES

IMPACT

2.10-1 Right-of-way acquisition associated with transportation improvements in the 2001 RTP could result in residential and business displacement or relocation.

MITIGATION

MTC shall require that project sponsors comply with CEQA (and NEPA if appropriate) prior to project approval by MTC. Project sponsors shall commit to mitigation measures at the time of certification of their project environmental document. Mitigation measures will be identified to the extent feasible to minimize impacts. These commitments obligate project sponsors to implement measures that would minimize or eliminate any significant community displacement effects. Mitigation for displacement effects involves the preparation and execution of relocation assistance plans that typically consider:

- Criteria for replacement housing;
- Reimbursement levels for moving costs and differential housing costs (including rents) to eligible displaces;
- Preparation of construction schedules to allow adequate time for all commercial and industrial businesses and residents to find and relocate to adequate substitute sites;
- Reimbursement levels for the costs associated with relocating a business to an acceptable facility, including search costs and criteria for payment in lieu of relocation if a business cannot be relocated. This is for businesses that cannot relocate without a substantial loss of the existing patronage.

SIGNIFICANCE AFTER MITIGATION

It is not expected that these mitigation measures would eliminate all community displacement effects. However, these mitigation measures would be expected to reduce this potentially significant effect on community displacement to a less-than-significant level if incorporated by project sponsors.

IMPACT

2.10-2 Transportation improvements in the 2001 RTP have the potential to disrupt or divide a community by separating community facilities, restricting community access to the region, or eliminating community amenities.

MITIGATION

MTC shall require that project sponsors comply with CEQA (and NEPA if appropriate) prior to project approval by MTC. Project sponsors shall commit to mitigation measures at the time of certification of their project environmental document. Mitigation measures will be identified to the extent feasible to minimize impacts. Additionally, MTC can encourage project sponsors through EIR comments to consider design elements in their projects that would maintain or enhance neighborhood accessibility.

SIGNIFICANCE AFTER MITIGATION

Project-specific mitigation measures would be expected to reduce this potentially significant effect on community disruption to a less-than-significant level if incorporated by project sponsors.

IMPACT

2.10-3 Construction of transportation improvements in the 2001 RTP could significantly disrupt adjoining communities in the short term.

MITIGATION

MTC shall require that project sponsors comply with CEQA (and NEPA if appropriate) prior to project approval by MTC. Project sponsors shall commit to mitigation measures at the time of certification of their project environmental document. These commitments obligate project sponsors to implement measures that would minimize or eliminate any significant community disruption effects. Typical mitigation measures that could be considered by project sponsors include:

- Regulate construction operations on existing facilities to minimize traffic disruptions and detours, and to maintain safe traffic operations;
- Ensure construction operations are limited to regular business hours where feasible;
- Control construction dust and noise; and
- Control erosion and sediment transport in stormwater runoff from construction sites.

SIGNIFICANCE AFTER MITIGATION

These mitigation measures may not reduce this potentially significant effect on short term community disruption to a less-than-significant level depending upon project size, location, and duration of construction.

2.11 Land Use

The San Francisco Bay Area has grown from the sparsely populated Native American and then Spanish settlements of the past to an urban area of nearly seven million people today. The pattern of land use in the Bay Area runs from one of the most densely populated urban centers in the United States (the City of San Francisco) to open hills and shorelines, and from growing suburban areas to still-viable farming areas.

This chapter describes trends in use of land for residential and employment purposes and trends in the density of new development projected by the Association of Bay Area Governments, based on their review of local general plans and the planning opportunities and constraints contained in these plans. in the Bay area. The transportation improvements in the 2001 Plan would have direct impacts on land use to the extent that resource lands are converted to transportation uses. . Additionally, the 2001 RTP would have a significant impact on land use if proposed projects and programs would be inconsistent with the adopted general plans of local jurisdictions.

While transportation improvements can have both near and long term affects on the land use patterns in a region, it is also true that many of the ongoing land use changes are occurring in the absence of complementary transportation improvements, due to other powerful socio-economic forces at work. Additionally while the 2001 RTP attempts to serve planned growth as expressed ABAG's projections, which in turn are based on local general plans, programs in the 2001 RTP—such as the Transportation for Livable Communities and Housing Incentive Program—are also intended to support local efforts that could reduce the demand for transportation services through the location, design, intensity, and design of new development.

SETTING

LAND USE PATTERN

Since World War II, the San Francisco Bay Area has grown from a primarily agricultural region with one major city (San Francisco) to the fourth most populous metropolitan region in the United States with multiple centers of employment, residential development, and peripheral agricultural areas. The pattern of land uses in the Bay Area includes a mix of open space, agriculture, intensely developed urban centers, a variety of suburban employment and residential areas, and scattered older towns. This pattern reflects the landforms that physically define the region, the Bay, rivers, and valleys. Major urban areas are centered around the Bay, with the older centers close to the Golden Gate. Newer urban areas are found in Santa Clara County to the south, the valleys of eastern Contra Costa and Alameda Counties, and Sonoma and Solano Counties to the north.

The Pacific coast and the northern valleys are primarily in agricultural and open space use, while the agricultural areas adjoining the Central Valley have seen substantial suburban development in recent years, particularly in Solano County and eastern Contra Costa County.

EXTENT OF URBAN DEVELOPMENT

The Bay Area is comprised of nine counties, including Alameda, Contra Costa, Marin, Napa, San Francisco, San Mateo, Santa Clara, Solano, and Sonoma. According to the Association of Bay Area Governments (ABAG), only about 15 percent of the region's approximately 7,000 square miles is developed. The remaining undeveloped area includes open space and agricultural lands as well as water bodies (excluding the San Francisco Bay) and parks.

The amount of land developed in each of the nine counties varies from a low of four percent in Napa County to a high of 81 percent in San Francisco. Residential uses continue to consume the greatest amount of urban land, almost 70 percent, while employment related land uses occupy about 30 percent.[1] Streets, highways, sidewalks, and parking are included in both categories and consume about 20 percent of the land in each, and accordingly, about 20 percent of the developed land in the Bay Area.

The Bay Area includes 98 cities, of which three cities—San Jose, San Francisco, and Oakland—represent the largest urbanized centers. Other major urban centers have formed throughout the region leading to the urbanization illustrated in Figure 2.11-1.

DENSITY OF DEVELOPMENT

Residential and employment densities vary widely among the areas of the region, with the highest densities associated with the older areas. Densities are of interest because of the way that they affect transportation options for Bay Area residents. Low density development by definition is more dispersed requiring greater reliance on autos for many trips, while higher residential densities on the order of 7.0 to 30.0 units/acre can sustain significant transit service.[2] A density of 8.0 units/acre is sometimes cited as the minimum density required to economically justify a fixed bus system operating at half hour headways.[3]

Average existing densities are shown for the MTC superdistricts in Table 2.11-1[4] and for counties in Table 2.11-2. The Bay Area averages for residential and employment density are 5 units per residential acre and 18 jobs per commercial or industrial acre.[5] The highest residential and employment densities occur in downtown San Francisco (which includes the North Beach and Chinatown neighborhoods) with 66 households per residential acre and 171 jobs per commercial or industrial acre.

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[1] ABAG, *Projections 2000,* Table 9, p. 20.

[2] Pushkarev, Boris and Zupan, Jeffrey, *Public Transportation and Land Use Policy*, Indiana University Press.

[3] Cervero, Robert, *Suburban Gridlock*, Rutgers, State University of New Jersey, 1986.

[4] The MTC divides the Bay Area into 34 "superdistricts." These superdistricts reflect the conglomeration of some 1,099 transportation analysis zones (TAZ) and are used in analysis, calibration, and presentation of MTC's transportation model (BAYCAST-90) output.

[5] The data used in the 1998 RTP EIR relied on ABAG *Projections '92* which reflects significantly higher residential and commercial densities. *Projections 2000* data reflects the most recent available data describing existing conditions in the Bay Area. It should be noted that the region is becoming more dense and that the difference between the data used in the previous EIR and this EIR is not the result of a different baseline year (2000 instead of 1990), but the use of an updated data set.

Figure 2.11-1
Urbanized Land in the Bay Area

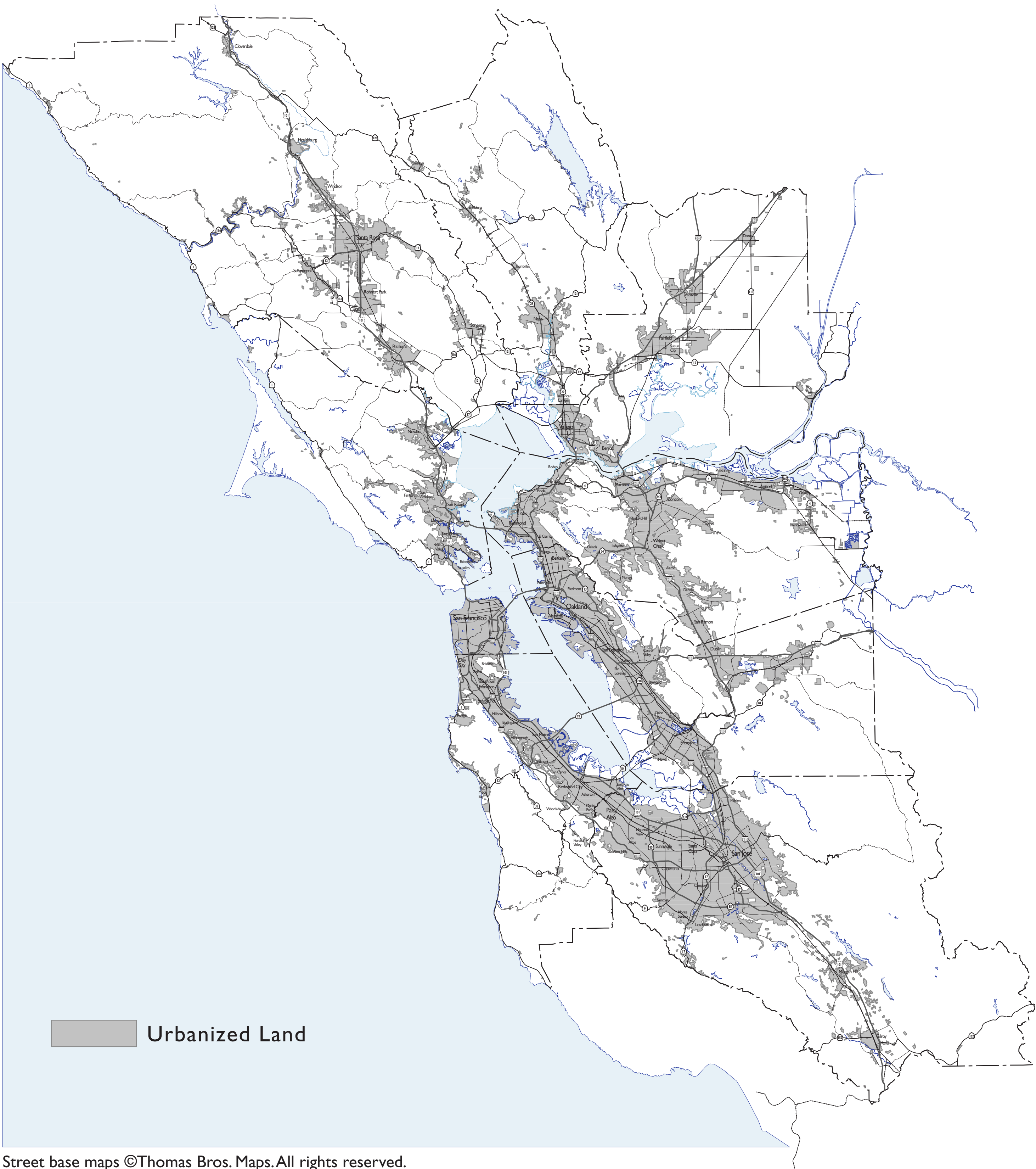

Table 2.11-1: Density of Development in the Bay Area by MTC Superdistrict

		Employment Density			Residential Density		
	Superdistrict	*Jobs*	*Commercial/ Industrial Acres*	*Density*	*Households*	*Residential Acres*	*Density*
1	Downtown San Francisco	380,367	2,221	171.3	61,580	932	66.1
2	Richmond District	81,706	1,761	46.4	97,847	3,761	26.0
3	Mission District	139,371	3,724	37.4	107,691	6,826	15.8
4	Sunset District	27,416	750	36.6	48,471	4,288	11.3
5	Daly City/San Bruno	163,342	8,583	19.0	97,391	11,820	8.2
6	San Mateo/Burlingame	104,309	3,640	28.7	79,568	12,211	6.5
7	Redwood City/Menlo Park	112,718	5,984	18.8	77,383	17,103	4.5
8	Palo Alto/Los Altos	166,624	4,928	33.8	69,446	16,913	4.1
9	Sunnyvale/Mountain View	395,541	18,087	21.9	87,830	10,977	8.0
10	Saratoga/Cupertino	150,443	5,769	26.1	117,194	28,083	4.2
11	Central San Jose	153,003	6,193	24.7	97,646	13,043	7.5
12	Milpitas/East San Jose	98,418	6,592	14.9	97,187	18,408	5.3
13	South San Jose/Almaden	65,962	2,760	23.9	68,725	14,121	4.9
14	Gilroy/Morgan Hill	47,236	3,384	14.0	29,052	8,677	3.3
15	Livermore/Pleasanton	117,602	8,368	14.1	61,653	14,286	4.3
16	Fremont/Union City	131,152	10,637	12.3	98,859	18,576	5.3
17	Hayward/San Leandro	160,933	11,216	14.3	119,795	20,863	5.7
18	Oakland/Alameda	209,560	12,846	16.3	166,522	19,832	8.4
19	Berkeley/Albany	106,542	3,201	33.3	67,792	6,343	10.7
20	Richmond/El Cerrito	74,731	9,678	7.7	83,901	16,265	5.2
21	Concord/Martinez	108,784	12,860	8.5	82,733	19,712	4.2
22	Walnut Creek/Lamorinda	75,143	2,822	26.6	58,462	22,234	2.6
23	Danville/San Ramon	52,481	2,002	26.2	42,778	17,183	2.5
24	Antioch/Pittsburg	48,951	6,556	7.5	70,992	16,683	4.3
25	Vallejo/Benicia	46,077	5,619	8.2	49,752	10,952	4.5
26	Fairfield/Vacaville	83,433	13,309	6.3	80,568	17,382	4.6
27	Napa	37,268	4,071	9.2	31,489	7,958	4.0
28	St. Helena/Calistoga	22,442	1,405	16.0	14,757	4,626	3.2
29	Petaluma/Sonoma	60,586	5,557	10.9	59,590	17,963	3.3
30	Santa Rosa/Sebastopol	123,841	6,672	18.6	82,919	32,520	2.5
31	Healdsburg/Cloverdale	19,103	2,518	7.6	29,015	17,599	1.6
32	Novato	25,988	1,567	16.6	21,439	6,590	3.3
33	San Rafael	55,384	4,473	12.4	42,443	13,188	3.2
34	Mill Valley/Sausalito	42,138	2,152	19.6	35,622	11,107	3.2

Source: ABAG, Projections 2000.

Table 2.11-2: Density of Development in the Bay Area by County

	Employment Density			*Residential Density*		
County	*Jobs*	*Commercial/ Industrial Acres*	*Density*	*Households*	*Residential Acres*	*Density*
San Francisco	628,860	8,456	74.4	315,589	15,807	20.0
San Mateo	380,369	18,207	20.9	254,342	41,134	6.2
Santa Clara	1,077,227	47,713	22.6	567,080	110,222	5.1
Alameda	725,789	46,268	15.7	514,621	79,900	6.4
Contra Costa	360,090	33,918	10.6	338,866	92,077	3.7
Solano	129,510	18,928	6.8	130,320	28,334	4.6
Napa	59,710	5,476	10.9	46,246	12,584	3.7
Sonoma	203,530	14,747	13.8	171,524	68,082	2.5
Marin	123,510	8,192	15.1	99,504	30,885	3.2
Bay Area	***3,688,595***	***201,905***	***18.3***	***2,438,092***	***479,025***	***5.1***

Source: ABAG, Projections 2000.

With respect to residential densities, after San Francisco, the Berkeley/Albany, Daly City/San Bruno, and Sunnyvale/Mountain View areas have the highest, while Healdsburg/Cloverdale, Santa Rosa/Sebastopol, and San Ramon/Danville have the lowest. Areas with the highest employment densities include San Francisco, Palo Alto/Los Altos, Berkeley/Albany, and San Mateo/Burlingame. Areas with the lowest employment densities include Fairfield/Vacaville, Antioch/Pittsburg, and Healdsburg/Cloverdale.

At the county level, with the exception of San Francisco County, the highest employment densities occur in San Mateo and Santa Clara Counties, while the highest residential densities occur in Alameda and San Mateo Counties. The lowest residential densities can be found in Sonoma County; the lowest employment densities in Solano County.

LAND USE AND FUTURE DENSITIES

The percent of land that is developed is forecast to increase by 115,000 acres between 2000 and 2020, an increase of 17 percent. This regional development will result in just over 18 percent of all Bay Area land being developed by 2020.

Overall regional population density has increased modestly in the last 10 years and is projected to remain essentially constant over the next 25 years, ranging from 13 to 14 persons per residential acre. Similarly, regional household density has remained constant in the last 10 years, a trend that is projected to continue over the next 25 years, at about 5 households per acre. The difference is in the average number of persons per household, which grew during the “baby boom” but will decline with the increasing number of “empty nesters.”

However, the projection of constant residential density is the result of two countervailing trends. New residential development on new residential acreage (currently undeveloped acreage) is projected to be developed at densities lower than the regional average, perhaps as low as 3.5 units per acre. However, a considerable amount of infill residential development is also occurring within major cities at very high densities. At least 25 percent of the new housing units in the Bay Area are forecast to be provided without any increase in developed acreage. This infill development within the established cities will contribute to greater transit use in the established core where transit is successful. Table 2.11-3 summarizes this information.

Table 2.11-3: Bay Area Land Use Characteristics

Land Use Characteristics	*1990*	*1998*	*2000*	*2010*	*2020*	*2025*
Population	5,868,700	6,564,300	6,779,300	7,473,400	7,863,700	8,060,900
Households	2,245,900	2,394,800	2,438,100	2,656,700	2,839,600	2,916,500
Residential Acres	448,000	470,900	479,000	530,900	572,100	575,900
Commercial-Industrial Acres	187,200	198,500	201,900	215,900	224,400	228,300
Developed Acres (Residential and Commercial-Industrial)	635,200	669,400	680,900	746,800	796,500	804,200
Total Acres	*4,436,800*	*4,436,800*	*4,436,800*	*4,436,800*	*4,436,800*	*4,436,800*
Population/Residential Acre	*13.1*	*13.9*	*14.2*	*14.1*	*13.7*	*14.0*
Households/Residential Acre	*5.0*	*5.1*	*5.1*	*5.0*	*5.0*	*5.1*
Population/Household	*2.61*	*2.74*	*2.78*	*2.81*	*2.77*	*2.76*
Percentage of Total Acres Developed	*14*	*15*	*15*	*17*	*18*	*18*

Source: ABAG, Projections 2000.

LAND USE AND ACCESSIBILITY

Historically, the introduction of new transportation technologies has led to significant changes in the pattern and extent of land use within a region. Early reliance on walking resulted in a pattern of dense cities with dense residential areas surrounding commercial, industrial, and warehousing areas along waterfronts. In the Bay Area, this pattern could be seen in San Francisco, Benicia, Sausalito, and Oakland. Later, the introduction of the railroad led to the development of new residential suburbs, which in the Bay Area were situated along the San Mateo and Marin Peninsulas. Streetcar and trolley systems caused the existing dense cities to spread out at a suburban scale as well. Finally, the introduction of the automobile and freeway systems allowed the expansion of residential and commercial development into formerly rural areas and led to the creation of a multi-centered Bay Area.

Despite the clear effect that the evolution of new transportation technologies has had on historic land use patterns, the effect of any single project or program of transportation improvements is generally tied to existing land use patterns. And increasingly, housing affordability, lifestyle and educational preferences, and public housing and tax policies, are key factors in land use decisions.

Other reasons why the link between transportation and land changes may be weakening are:

- Local general plans, zoning and other land use regulations, as well as local political attitudes limit the ability of developers from responding to changes in accessibility.

- As the relative cost of transportation has decreased, so too has the role of transportation in location decisions.[6]
- Most importantly, recent changes in accessibility have been too small to change the cost of travel significantly within the urban area.

Finally, in a multi-centered region, any one location is equally accessible to many other locations, which necessarily limits the effect that relative accessibility has on the choice of location.

CRITERIA OF SIGNIFICANCE

This EIR will use the following criteria to assess whether the 2001 RTP will have a significant adverse effect on land use:

- **Criterion 1: Converts resource land to transportation use.** Implementation of the 2001 RTP would have a potentially significant impact if it converts important agricultural lands, open space, or other natural resources for the development of transportation facilities. Such conversion from natural resource use would be significant whether or not the proposed facility is consistent with local or regional plans.
- **Criterion 2: Conflicts with local plans.** Implementation of the 2001 RTP would have a potentially significant impact if it conflicts with the land use portion of adopted local General Plans or other applicable land use plans, such as specific area plans.

This analysis addresses the effects that the proposed 2001 RTP could have on the use of land. Other potential adverse environmental effects of transportation projects on land uses, such as noise and air quality, etc., are addressed in the respective sections of this EIR.

METHOD OF ANALYSIS

CONVERSION OF RESOURCE LAND TO TRANSPORTATION USE

The first step in determining if the transportation improvements in 2001 RTP would result in the conversion of resource land to transportation uses is to identify which improvements would require the development of significant undeveloped land areas. Next, the location of proposed improvements in the 2001 RTP will be compared to the location of known important natural resource lands to assess the potential for the proposed 2001 RTP to convert significant natural resource land areas to transportation uses. Important natural resource lands include prime agricultural lands designated by the State of California, and parks and open space lands in public ownership or control. Important habitat areas are discussed in Chapter 2.5.

The analysis will also consider whether the land required is within an existing right-of-way or requires a widened or new right-of-way. Next, the location of proposed projects in the 2001 RTP

[6] Ibid, p. 9.

will be compared to the location of known important natural resource lands to assess the potential for the 2001 RTP to convert significant natural resource land areas to transportation uses. Important natural resource lands include prime agricultural lands designated by the State of California, and parks and open space lands in public ownership or control. Important habitat areas are discussed in Chapter 2.5.

CONFLICT WITH LOCAL PLANS

Most of the projects submitted for inclusion in the 2001 RTP are developed through a local review process that involves local jurisdictions working with the county Congestion Management Agencies (CMAs) or relevant transportation authority. For this reason, it is unlikely that any project submitted would be inconsistent with a local jurisdiction's plan, because the project would not have been forwarded in the first place. However, should a project be found to be inconsistent with the land use portion of a local General Plan, it would be identified as having a significant adverse impact.

SUMMARY OF IMPACTS

DIRECT IMPACTS

Implementation of the transportation improvements in the 2001 RTP could result in long term land use impacts. There are no short term impacts on land use.

Conversion of Resource Land

Table 2.11-4 identifies the transportation improvements in the 2001 RTP that could result in the conversion of agricultural, open space, and natural resource lands to transportation use. The likelihood of conversion would be increased where transportation improvements are located at the edges of existing urban areas, along waterways, or over hills that separate urbanized areas. The extent of this impact will depend upon on the final design of the transportation improvements identified, including the width and location of the existing right-of-way (if any). The degree of this impact will depend upon project-specific analysis required by CEQA to determine the importance of the resource land to be converted.

However, given the predominant location of most transportation improvements within developed areas, and the fact that these improvements focus on transportation deficiencies within existing corridors, the conversion of resource land is likely to be limited. Generally, even where additional right-of-way would be required, relatively little resource land would be converted. One reason for this is that most of this resource land is located within existing municipalities that have already planned for its conversion to urban uses. In other cases, even prime agricultural land adjacent to some transportation improvements is used for grazing (which is not an endangered agricultural activity in the Bay Area) and is not in agricultural production. While on a regional level the conversion of resource lands to transportation uses would not be significant—especially compared with the amount planned for conversion to residential and commercial uses—some conversion could be significant locally.

Table 2.11-4: 2001 RTP Projects with Potential to Convert Resource Land

Corridor	*Project*	*Potential Impact*
Golden Gate	Widen US 101 from 4 to 6 lanes between Rte. 37 and Sonoma County line	Conversion of adjacent grazing lands
	US 101 northbound and southbound HOV lanes between Marin County line and Old Redwood Highway	Conversion of adjacent agricultural lands
	US 101 northbound and southbound HOV lanes between Old Redwood Highway and Rohnert Park Expwy.	Conversion of adjacent agricultural lands
	US 101 northbound and southbound HOV lanes between Steele Ln. and Windsor River Rd.	Conversion of adjacent prime agricultural lands
North Bay East-West	Widen Rte. 12 from 2 to 4 lanes between I-80 and Rte. 29 (Jameson Canyon)	Conversion of adjacent prime agricultural lands and grazing lands
Napa Valley	New Rte. 221/Rte. 29 flyover	Conversion of adjacent grazing lands should additional right of way be required
Eastshore-North	Widen existing routes (Walters Road, Cement Hill Road, Vanden Road, Leisure Town Road) to create to establish 4 lane Jepson Parkway from Rte. 12 to I-80	Conversion of adjacent prime agricultural lands and grazing lands.
	Eastbound and westbound HOV lanes between I-680 and I-505	Conversion of adjacent prime agricultural and grazing lands
	Widen I-80 from 6 to 8 lanes between Vacaville and Dixon	Conversion of adjacent prime agricultural and grazing lands
Delta	Upgrade Rte. 4 to full freeway between I-80 and the Cummings Skyway	Conversion of adjacent grazing lands
Eastshore-South	Widen Union City Blvd. from 4 to 6 lanes from Paseo Padre Ave. to Industrial Pkwy.	Conversion of adjacent prime agricultural lands
	Rte. 84 southbound HOV extension from Newark Blvd. to I-880	Conversion of adjacent prime agricultural lands
Fremont-South Bay	Westbound auxiliary lanes on Rte. 237 between Coyote Creek Bridge and North First St.	Conversion of adjacent prime agricultural lands
Silicon Valley	Rte. 25 upgrade to expressway from Bloomfield Ave. to San Benito County line	Conversion of prime agricultural lands and agricultural lands of statewide importance
	Widen Montague Expressway from 6 to 8 lanes between I-680 and U.S. 101	Conversion of strip of agricultural land between Coyote Creek and Seeley Ave.

Source: Dyett & Bhatia, 2001.

Conflicts with Local Plans

The interagency screening and evaluation process for all locally-sponsored transportation improvements is built upon the foundation of local general plans. The proposed transportation improvements in the 2001 RTP originate from the Congestion Management Programs of each county, the Countywide Transportation Plans for a number of counties, and the service plans for a number of transit agencies. These plans and programs have been developed to consider the current needs and future demands identified in local general plans. While transportation improvements on State and Interstate highways and those sponsored by special districts—such as BART, AC Transit, SAMTRANS, etc.—are not necessarily derived from local general plans, they are reviewed for consistency with such plans through the funding and environmental review processes. As a result, the proposed transportation improvements in the 2001 RTP effectively do not conflict with the land use designations of local general plans.

Although the proposed transportation improvements in the 2001 RTP are consistent with local general plans, local jurisdictions and countywide agencies may differ on the priority given to specific projects. For instance, in some cases a local jurisdiction or countywide agency may want a specific transportation improvement included among those proposed in the 2001 RTP and it is not. In others, a local jurisdiction or countywide agency may want the definition of a specific transportation improvement in the 2001 RTP expanded to include later phases of the project. Since the 2001 RTP is financially constrained, such difference in opinion is inherent in the preparation of Plan. However, these differences may have implications for planned development since cities and developers—both responding in part to the marketplace—may postpone or alter development projects in response to the deferment of necessary transportation improvements. If development proceeds without the necessary transportation improvements, then increased congestion would be the likely result.

Other Direct Impacts

The implementation of some transportation improvements in the 2001 RTP could adversely affect adjoining land. Impacts could include increased noise, displacement of existing land uses, disturbance of cultural resources, loss or modifications to significant natural habitats, etc. While these impacts can affect the compatibility of the proposed transportation improvements with adjoining uses, these impacts are not addressed in this chapter but in the related chapters of Part Two of this EIR.

INDIRECT/CUMULATIVE IMPACTS

The proposed 2001 RTP will be implemented concurrently with significant residential, commercial, and industrial development in the Bay Area over the next 25 years. ABAG forecasts that the region will add about 1.3 million new residents and about 1.2 million new jobs between now and the year 2025. This growth will require the conversion or redevelopment of considerable land areas of the region. ABAG estimates that about 96,900 acres of land will be converted over the next 25 years to accommodate residential development, a 20 percent increase in the amount of developed residential land. About 26,400 acres of land will be converted over the same period to accommodate commercial development, a 13 percent increase in the amount of developed commercial land. Currently, 15 percent of Bay Area land is developed, an amount that is expected to increase to 18 percent over the next 25 years.

Much of the additional land area needed to accommodate this growth is now in resource use and is located at the edges of existing urban areas. These lands would, over time, be converted to home sites, shopping areas, office and manufacturing sites, and public facilities, including roadways. The transportation improvements in the 2001 RTP would, together with the projected population and job growth in the Bay Area, result in cumulative land use impacts.

In general, the cities and counties in the Bay Area have more land planned for development than will be required to meet the needs of the projected population and employment growth to the year 2025. This is particularly true for commercial and industrial lands where there is about 87 percent more land available than will be needed to meet demand by 2020. Currently, six of the nine Bay Area counties do not have an inventory of residential land sufficient to meet the demand for housing projected by ABAG, including Alameda, Napa, San Mateo, Santa Clara, Solano, and Sonoma. Sonoma is the only county with a shortfall of commercial/industrial land available to meet the employment growth projected by ABAG. In instances where a surplus of land exists relative to the demand, the trend toward decentralization of existing urban centers with growth development nodes located in inland valleys would be expected to continue. Jurisdictions that favor employment-generating over residential development are likely to see increased traffic volumes and congestion on commute routes.

SIGNIFICANT IMPACTS AND MITIGATION MEASURES

IMPACT

2.11-1 Construction of certain transportation improvements in the 2001 RTP, such as the expansion of existing facilities and the construction of new facilities, could convert resource lands, including prime agricultural lands designated by the State of California and parks and open space lands in public ownership or control, to transportation uses.

MITIGATION

MTC shall require that project sponsors comply with CEQA (and NEPA if appropriate) prior to project approval by MTC. Project sponsors shall commit to mitigation measures at the time of certification of their project environmental document. These commitments obligate project sponsors to implement measures that would minimize or eliminate any significant impacts resulting in the conversion of resource lands. Typical mitigation measures that could be considered by project sponsors include:

- Corridor realignment, where feasible, to avoid resource land areas;
- Buffer zones and setbacks to protect the functional aspects of resource land areas; and
- Berms and fencing to reduce conflicts between transportation uses and resource land uses.

SIGNIFICANCE AFTER MITIGATION

Despite the potential limitations on the extent of resource land converted that would be provided by the mitigation measures proposed here, these measures are not expected to reduce this potentially significant impact to a less-than-significant level in all cases. The extent of this impact will depend upon on the final design of each transportation improvement. The degree of this impact will depend upon project-specific analysis required by CEQA to determine the importance of the resource land to be converted.

CUMULATIVE IMPACT

2.11-2 Concurrent implementation of the proposed 2001 RTP and forecast development of residential and employment land uses in the Bay Area over the next 25 years would result in a significant expansion of urban areas and significant changes in land use and the character of neighborhoods and districts in the Bay Area.

Approximately 6.1 percent of the land in the Bay Area is planned for conversion to urban uses over the next 25 years. Although ABAG projects that the total market demand for urban land is likely to be less over the same period, more than 123,300 acres could be urbanized according to ABAG projections. The resulting changes in both the regional pattern of land uses and that of local neighborhoods and districts would have important secondary impacts.

MITIGATION

While MTC has no land use authority and cannot directly affect the pattern that future land uses will take, it can continue to participate in and promote the efforts of the Regional Agencies Smart Growth Initiative which is intended to coordinate regional smart growth efforts to use land more efficiently, optimize transportation and other infrastructure investments, preserve open space, etc. In this way, MTC can pursue the enhanced coordination of local land use plans and investments in the 2001 RTP.

SIGNIFICANCE AFTER MITIGATION

This mitigation measure is not expected to reduce this potentially significant cumulative impact on land use a less-than-significant level. As such, this impact would likely remain significant.

CUMULATIVE IMPACT

2.11-3 The amount and location of new development can have locally significant effects on transportation demand, and on the location and amount of congestion.

Depending upon the location of population and employment growth, local land use decisions can have significant impacts on the transportation system and levels of service provided. Currently ABAG is projecting that Alameda, Napa, San Mateo, Santa Clara, Solano, and Sonoma Counties will not have an inventory of residential land sufficient to meet the demand for housing projected over the next 25 years. It is also projected that significant increases in commuting from outside the Bay Area where housing costs are lower, and are likely to remain lower, could occur. As in Impact 2.11-2 above, the amount and location of new development has significant secondary impacts on transportation systems and could create investment needs that cannot be accommodated given the sources and availability of transportation funding.

MITIGATION

While the secondary impacts of local land use decisions on the transportation system in the Bay Area are potentially significant, the mitigation associated with Impact 2.11-2 above could lead to the enhanced coordination of local land use plans and investments in the 2001 RTP. MTC also supports better integration of transportation and land use through its Transportation for Livable Communities (TLC) program and Housing Incentive Program (HIP).

SIGNIFICANCE AFTER MITIGATION

This mitigation measure is not expected to reduce this potentially significant cumulative impact on land use to a less-than-significant level. As such, this impact would likely remain significant.